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INTERNAL MEDICINE

A WORK FOR THE PRACTICING PHYSICIAN
ON DIAGNOSIS AND TREATMENT
WITH A COMPLETE DESK INDEX

IN THREE VOLUMES

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Vol. III

TREATMENT

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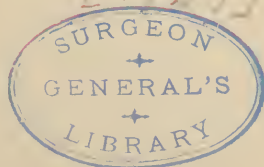
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"The whole Art of Medicine is in Observation."



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PREFACE

THE primary reason for placing this book before the medical profession is to provide a volume which will outline the treatment of the various diseases which have been so ably described in Professor Wilson's volume on Diagnosis, and to thus complete a small set of books which it is hoped will fill a need of the practitioner. With this object in view the effort has been made to follow the arrangement of the second volume and to provide, as nearly as is possible without ambiguity, articles upon treatment to cover each of the diseases in the order in which they appear in the Diagnosis.

With the Infectious Diseases this may easily be done, but in other instances it does not appear practicable without sacrificing clarity or unless there is useless repetition. For this reason it will be found that the treatment does not always follow the Diagnosis, notably in Diseases of the Heart. When there is disease of the heart, for instance, it must be known first whether or not the heart is functioning properly for the state of activity of that individual; and the immediate treatment, at least, and often all the treatment, is based upon the answer to that question. In these instances, however, such apparent discrepancies have been corrected in the index, and by its use the physician may logically conclude the review of any disease he may have under consideration.

In all discussions of treatment, the practitioner, his needs and the facilities he has at hand have been kept in mind. Of late years there have been introduced into medicine a great many specialized procedures, some requiring expensive or intricate apparatus, others a long and intensive training in their use. Many of these procedures, both for diagnosis and treatment of disease have been apparently brilliantly successful after the trial of a year or two, but when generally used by the profession in a great many cases, rapidly pass into oblivion. Again, some of the newer methods and drugs have by no means been yet proven satisfactory. For these reasons it may be found that not all of the therapy now advocated has been included in this volume, but if such omissions are noted it is because it is felt that the treatment has either failed when applied to large numbers of cases or is still in the experimental stage. In some instances it will be found that a method is advised but that the technic and dosage have been omitted—notably so as regards the use of x-ray and radium. There can be no doubt that these two agents are valuable therapeutic measures in selected cases, but there is also no doubt that their use should be limited to the man who has had wide experience with them, as in the hands of the inexperienced they are capable of great harm. When the average practitioner has the necessary experience and the means at hand to carry out any procedure, technic, application and dosage have been fully discussed.

As medicine has progressed we have learned to recognize states of disease earlier, and to better know the causes which lead up to them. This

knowledge has opened up the field of preventive medicine, not only for the prevention of the infectious diseases, but for chronic diseases of the vital organs, and it is believed that soon the patient will be demanding that he be saved from the suffering of a chronic illness late in life, and not only that his children be prevented from contracting measles. Such patients will also be discovered earlier and they must be taught how to live comfortably within their disability.

In the past, and to a large extent now, we have used a great many remedies for which unwarranted therapeutic claims have been made. For this reason the drugs which have been included in the volumes "Useful Drugs," and "New and Non-official Remedies" both published by the American Medical Association have been largely adhered to, though one may be pardoned if he does not in every instance agree with the therapeutists who compiled that list. Throughout the book there have been inserted at appropriate places the therapeutic action of some of the more important drugs, so that the practitioner may better understand exactly what he is accomplishing when he orders one of these remedies.

SAMUEL BRADBURY.

NEW YORK CITY, January, 1923.

FOREWORD

MEDICINE is an art based upon many sciences. Science is systematized knowledge gained by observation, experiment and reasoning; art is the employment of a given means to effect a purpose. One of the definitions of philosophy is the application of reason to its legitimate objects. Medicine, as it becomes more reasonable, becomes more philosophical; as it becomes more philosophical, it becomes more scientific; as it becomes more scientific, it becomes more efficient as an art. The objects of medicine are the prevention and healing of disease and the alleviation of suffering. To accomplish these objects, it demands the services of the sciences, especially those of the biological group. But it employs these only as the means to an end, namely to prevent and cure. Therapeutics is the goal of medicine. Osler has said that it is a fundamental law that the starting-point of all treatment is in the knowledge of the natural history of a disease. But in the absence of a knowledge of causes, natural history is impossible. In the fogs of mysticism and superstition medicine groped through long centuries in vain for light. There were great names—Hippocrates, Galen, Harvey, John Hunter. But authority and precedent, which are the life of the law, yield no such service to medicine. It was not until Pasteur, about the middle of the last century, brought to the study of causes the systematized knowledge which we call science, that medicine began to find the light of reason. Since that beginning, the advance has been so rapid as to be almost bewildering. The old influences have, however, not been wholly displaced, witness Our Lady of Lourdes, St. Anne de Beaupré and Mother Eddy. Nor, in fact, are our scientific methods wholly free from errors of unreason, inconclusive reports, unavailable statistics and wearying efforts to find in "cases" something new and strange, oblivious of the fact that the objects of our art are the prevention of disease, the cure of sickness and the alleviation of human suffering.

To these objects this book is hopefully inscribed.

In making a handbook of this kind it is necessary to draw freely upon the great fund of acquired information which has become the common property of the profession. To the workers whose contributions have formed that fund, and who are daily adding to it, the Authors tender grateful acknowledgment for its use. Those whose work is especially referred to are mentioned by name, but as a general rule it has been impracticable, for want of space, to append systematic references to the literature. The writer of the sub-sections upon the Thyroid Gland in Vol. II and Vol. III desires to particularly thank Professor Henry S. Plummer for permission to quote freely from his recent publications; and the same writer wishes to express his thanks to Messrs. Lea and Febiger for the privilege of drawing somewhat extensively upon matter, formerly contributed by him, concerning alcohol and lead, in a publication in which they have copyright control.

J. C. WILSON.

PHILADELPHIA, January, 1923.

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A HANDBOOK *of* TREATMENT

INTRODUCTION.

HYGIENE: COMMUNITY AND PERSONAL.

SAMUEL BRADBURY.

Prevention of disease has today assumed such importance in medicine, and, in the infectious diseases particularly, is so interwoven with the treatment, that it appears advisable to review briefly some of the aspects of preventive medicine.

Disease prevention may be broadly divided into Community Prophylaxis and Personal Hygiene.

Community Prevention.

Community prophylaxis is a specialized branch of medicine in charge of sanitarians represented by boards of health, and, fundamentally at least, is concerned with the prevention of the acute epidemic infectious diseases.

For public health purposes the acute infectious diseases may be grouped as: (1) *Personal contact infections*, such as small pox, scarlet fever and the respiratory diseases; (2) *Insect-borne disease*, such as malaria, typhus and plague; and (3) *The water and food infections*, such as typhoid fever, cholera and those caused by the animal parasites.

In exceptional cases each class of disease may be due to any one of the modes of infection. In the presence of epidemics, however, the sanitarian is interested in the source from which that particular disease most frequently results.

In the control of disease due to personal contact and to insect transmission, boards of health must have the coöperation of physician and layman in a prompt reporting of cases, and in the rigid observance of the rules of quarantine and other means of control that may be decided upon. Furthermore, boards of health make laws or suggestions for well tried methods of prevention, as vaccination for small pox, rat-proofing of buildings for plague, or requests for the prevention of crowding as was done in the recent epidemic of influenza in asking that opening hours of business be "staggered" to lower and broaden the peak of the traffic rush. In the prevention of diseases which are not ordinarily found in this country, the health officer works at the large seaports. He examines for signs of disease, delouses the prospective citizen, or detains him until incubation periods

have passed. Rules for the control of diseases of these classes are discussed in the appropriate sections.

In the control of epidemic disease due to infection from water or food the sanitarian has the problem peculiarly in his own hands. Owing to modern civilization, with the crowding into cities, and the consequent necessity for the bringing of food and water from distances, the individual is unable to control his source of supply and has entrusted this duty to his health officer. The efficiency of the health officer in any particular depends upon the funds with which he is provided, and the power he is given to make his recommendations effective.

Water.—Of primary importance in the community control of water- and food-borne disease is a water supply which is adequate in amount and at all times free from infectious bacteria.

When one considers that the average daily minimum for drinking and washing is about 15 gallons per person, and that in manufacturing cities as much as 250 gallons a day for each inhabitant may be required, the proportions of the problem are manifest.

For large towns and cities, the settling basin and sand filter, an artificial, or natural lake with a protected water shed and aqueduct, or, chlorination by a mechanical apparatus which will add 1 to 3 parts of chlorine per million parts of water, are the usual methods employed for the purification of water supplies. Any method demands constant supervision of its human and mechanical parts, and frequent examination, for intestinal bacteria, of the water actually delivered.

Most cities and towns of any size in the United States have learned of the economical advantages of an adequate purification system, but the water supply of the rural population is still a great problem. It is more nearly one of personal prevention, but the occurrence of uncontrolled infections of this class in any location is a menace to any community situated upon the same drainage area. Indifference to or ignorance of the danger, or the expense of properly located and constructed wells, deters most villages and farm houses from adopting proper water safeguards. For these smaller supplies however, drinking water may be rendered perfectly safe by boiling, or, more practicable when it must be done continuously, by the use of chlorinated lime. The Army capsule of 1 gram (15 grains) of chlorinated lime well mixed into 40 gallons of water, renders a polluted supply safe to drink in one-half hour.

Sewage.—The problem next in importance for the health authorities is a safe disposal of sewage. In thickly settled districts especially, some method of purification should be employed before dumping sewage into river or lake. Spreading the liquid on sandy soil, chemical precipitation, and various forms of filter are employed for large amounts. For the communities of over 3000 inhabitants a universal waste drainage system is a necessity, and in all such groups it is best that even the outlying houses be connected with a sewer. In the country, where cesspools or privies are used, there should be a water-tight receptacle for human waste, to prevent

contamination, of nearby wells, by ground seepage. A septic sedimentation tank may be used, with an overflow pipe leading to another tank. A large amount of the waste material ferments and is carried away by evaporation and gas formation, and the development of saprophytic bacteria kills the pathogenic organisms. The overflow from the second tank, the effluent, may be allowed to drain away through sandy soil. For privies the same contrivance may be employed; or a removable receptacle may be used, and, at intervals, the contents be burned or buried in a location distant from any water supply. Flies must be excluded from access to the contents of receptacles by self-closing lids for the seats, and wire gauze over all other openings.

Food.—The health authorities should also have oversight of the milk and other food supplies, of food handlers in shops and hotels, and of irresponsible persons, carriers, who harbor pathogenic bacteria, and endanger the lives of persons whom they serve. It seems only just to lock up a typhoid bacilli-carrying cook who, after defecation, persists in the filthy and dangerous habit of refusing to wash her hands before resuming the preparation of meals.

Personal Hygiene

The recent universal draft furnished the most extensive statistics upon the physical condition of men from 21 to 30 years of age that it has been possible to obtain in this country since the Civil War. The results of these examinations have been tabulated and analyzed under the direction of the Surgeon General of the Army.

Up to December 1917, approximately two and one-half million men were examined by the draft boards in all parts of the country, and about 730,000 of these men were rejected for service on physical grounds. In every 1000 men there were found 468 with one or more defects, and in 291 per 1000, these defects were of such character that the men were considered unfit for military training.

In classifying and estimating the frequency of the various physical imperfections, they were tabulated as follows:—

Mechanical defects, feet, hands, hernia, etc.	39	per cent
Defects of sense organs, 75 per cent. eye, 25 per cent. ear.	12	per cent
Tuberculosis 5.5 per cent. venereal disease 5.5 per cent.	11	per cent
Cardiovascular defects and disease.	10	per cent
Developmental and metabolism disorders.	10	per cent
Nervous and mental disease.	6	per cent
Nose and throat defects.	5	per cent
Defects of skin and teeth.	3	per cent
Respiratory disorder other than tuberculosis.	1	per cent
All other causes.	3	per cent

In the study of men brought up under different conditions in different parts of the country, the numbers and variety of defect varied considerably. In certain sections of the United States the preponderance of some disease conditions appeared to depend upon such factors as race and nationality, customs, the density of population, and upon the general occupation of the people of the region.

In city districts, 38.3 per cent. of the men had physical defects, and 21.68 per cent. were rejected. Foot deformity was more frequent, as were also goiter, alcoholism, drug habit, syphilis, refractive visual errors, otitis media, functional heart disease, bad teeth, hernia, poor physical development, under and overweight and the various congenital malformations.

In men bred in the country, 33.3 per cent. had defects, and 16.98 per cent. were rejected. There was a higher percentage of all forms of tuberculosis, of the venereal diseases except syphilis, of chronic arthritis, ankylosis of joints and malunion of fractures, of most of the nervous and mental diseases, and of the various forms of conjunctivitis.

With further study of these problems all boys may perhaps be given the advantages of the factors which lowered the defective rates amongst some classes of the registrants.

The important lesson to be gained from the facts disclosed by the draft board examinations is the clearly shown necessity for a better knowledge of personal hygiene in the youth of the country, and the opportunity for constructive and repair work in many adults.

Since the worst of the epidemic infectious diseases have been brought under control in normal civilized communities, boards of health have taken up other work, such as the prevention of infant mortality, the care and ventilation and heating of buildings for public assembly, improvement of factory conditions for the benefit of employee and consumer. Many boards of health conduct public lectures or newspaper campaigns for improved personal hygiene, but the best work in teaching individuals to live properly will be done by the family physician. He knows the idiosyncrasies of each patient, can best tell what measures should be taken to correct beginning chronic abnormalities and prevent recurring infections, and how best to overcome handicaps of heredity and environment.

Of material value in keeping well is the periodical examination. A number of commercial organizations now maintain expensive medical departments for the examination of all employees. The medical supervision of employees is still in its experimental stages, but the fact that a commercial enterprise willingly pays the bill for disease prevention, and, in some cases, for the medical care of workers and even of their families, proves that they find it effective in preventing sick leave or labor turnover, and thus lower their labor costs. When these examinations are made the general rules of personal hygiene may be pointed out, and any special regime, necessary to correct defects found, is emphasized.

Factors responsible for sub-standard health are:—

A bad heredity.

Faults in atmospheric surroundings.

feeding, both in amount and in balance,
clothing,
daily habits in regard to the digestive tract,
sleep,
work,
recreation.

Infections, hereditary or acquired
 acute or chronic,
 local or general.

Air.—Normal clean air contains:

Nitrogen.....	78.09 per cent
Oxygen.....	20.94 per cent
Argon.....	0.94 per cent
Carbon dioxide.....	0.03 per cent

There seems to be no doubt that the average person living and working in the open country air is in better health than the average indoor city worker. Even the open air of cities is more healthful than that indoors, but to many adults the benefits of outdoor air are denied except on the way to and from work. Such persons should live and work indoors under the best possible atmospheric conditions.

During the past 20 years experiments by Flugge, Hill, Haldane, Benedict, Winslow and their co-workers, have decidedly changed previously accepted ideas as to what constitutes good atmospheric conditions in closed rooms. An abundance of fresh clean air is desirable, but, in order that the persons concerned may be comfortable and that a continued high degree of efficiency be maintained, other factors appear to be more important, and, curiously, they are the conditions which affect the skin and heat regulation rather than the lungs or oxygen supply to the blood.

The most necessary of these factors is that the air be in *gentle motion*. This prevents the formation of a layer of air in the clothing next to the body, which will have almost body temperature and a high humidity from evaporation of water from the skin. When the surrounding air is in motion the skin is stimulated, kept relatively dry, and properly performs its function of regulating body heat. This will explain why the fan is such a relief in hot weather, and the refreshing quality of the breeze which may come after sundown on a scorching day.

Next in importance are the *temperature and humidity* of the closed room. The best temperature for sedentary occupations is from 65 to 68° Fahrenheit; for active indoor work about 5 to 10° less, with the humidity in either case about 50 per cent. In New York City schools, Dr. Josephine Baker found respiratory diseases in children in attendance, and absences caused by them, to be much less in rooms averaging these temperatures than in those rooms averaging as little as 3° to 4° warmer. In summer, when such low temperatures cannot be maintained, it is necessary that the humidity be lessened and that the air motion be increased to promote the natural heat dispensing mechanism of the body. The "Curve of Comfort" worked out by Ellen H. Richards, varies from a temperature of 54° F. and humidity of 75 per cent. to the temperature of 85° F. and humidity of 20 per cent. The most deleterious effects are seen in persons exposed to atmospheres of high temperature with almost complete water saturation, and these are considerably worse when there is no movement of the air.

Air should be relatively free from *dust and fumes*. A high dust content of sharp particles increases the incidence of tuberculosis and of pneumonia.

while much coal dust, which is relatively soft, appears to inhibit the development of tuberculosis, but increases pneumonia.

Air fouled with *body odors* is undeniably repulsive. One series of experiments conducted by the New York State Committee on Ventilation, if confirmed, may prove it to be unhygienic in suppressing the appetite, even when the persons experimented upon did not perceive the odors.

Experiments have shown that the oxygen and carbon dioxide content of air, under any conceivable normal conditions, are of little moment in causing any noticeable physiological abnormality or even personal discomfort. The air in some test chambers was allowed to become so deficient in oxygen and so full of carbon dioxide that matches would not burn. As long as the chamber was cool and the contained air in gentle motion the inhabitants were comfortable.

A satisfactory amount of clean fresh air may be difficult to obtain in day time, but during sleep, about one-third of each 24 hours, every one may have all the outdoor air that the available window space affords, and of it every advantage should be taken in all kinds of weather. Certainly, in persons used to it, a gentle breeze on the face promotes quiet restful sleep.

Food.—The food ingested rebuilds tissue waste, is the source of body heat, and of muscular power, and supplies salts, bulky material for regulation of the bowels, and some indeterminate substances, as yet little understood, which are known as vitamins (see chapter on deficiency diseases).

Food substances which rebuild waste and from which new cells are formed are known as *proteins*, and are best exemplified in meat, eggs, and cheese. Those the source of energy are the *fats*, such as butter, olive oil and meat fat, and the *carbohydrates*, such as sugar, the cereals and starchy vegetables. The third class of foodstuffs, called supplementary foods, are mainly the "green vegetables," all characterized by a low carbohydrate content, the bulk of the material being water and cellulose. Most foodstuffs contain several of the necessary substances, but, for the ordinary dietetic purposes, one of these is in such preponderance that foods are spoken of as belonging to that class.

Stated amounts of protein, of fat, and of carbohydrate have definite energy values, and these are expressed in calories. The *calory*, as used in the diet, is the amount of heat necessary to raise the temperature of 1 kilogram of water through 1 degree (Centigrade). Protein and carbohydrate each have values of 4.1 calories per gram of pure substance, while fat has an energy value of 9.3 calories per gram. Foods have been analyzed for the amounts of digestible, or available, protein, fat and carbohydrate they contain, and, from these percentages, the food value of a given weight of any substance eaten may be easily estimated. Tables in the section on Diseases of Metabolism give the average composition and fuel values of various foods.

Food intake may affect the health by being excessive or deficient, or by being incorrectly balanced. Balance in food should provide for a

proper amount of protein, fat and carbohydrate, sufficient vitamins and inorganic salts, and a certain amount of indigestible residue which will keep the bowel movements regular.

For the individual the best estimate of the value of the food ingested is furnished by the scales, the state of the bowels, and of the digestion.

The physician should know the body-building or energy-forming value of each food, the method of dividing the diet so that the body receives the proper amount of each class of food, and the average caloric requirement of individuals at varying occupations and of children at different ages.

The Inter-Allied Scientific Food Commission of 1918, calculated that a man doing an average day's work should have 3000 calories per day. For children of varying ages and for women, they then adopted allowances of food based on the requirement of the average man as follows:—

	Age in years.	Relative amount.	Calories.
Child.....	0 to 6	0.5	1500
Child.....	6 to 10	0.7	2100
Child.....	10 to 14	0.83	2490
Boy.....	14 to 16	1.00	3000
Girl.....	14 to 16	0.83	2490
Man.....		1.00	3000
Woman.....		0.83	2490

These amounts were calculated for the whole population for the minimum amount of food required for health and efficiency, and are subject to considerable variation. The amounts for children of one to three years are probably more than they would take under any circumstances. It is usually calculated that an adult at rest in bed requires 1500 to 1700 calories, in sedentary occupations, 2500 calories, and at hard work, 3000 to 4000 calories. Women, because of their smaller size, require about 15 per cent. less food than men. Farmers in the United States eat about 3500 calories. The United States soldier in training was provided with 4800 calories, and, in the trenches in winter, with as much as 5000 calories. It has been estimated that English school boys of ten to sixteen years will eat about 3500 calories, and American school boys, when part of the time they exercised out of doors in winter, ate 5000 calories. While growing children require more calories per unit of weight than do adults, at the time of puberty boys apparently require a relatively greater increase than do girls at the same period.

The increased heat loss in winter and the energy expenditure of hard manual labor or exercise require more fuel. Such needs are illustrated in the hearty appetite of the athlete or outdoor worker, and in the blubber eating of the Eskimo.

Normal adults should have their diets, estimated as calories, so proportioned that 10 per cent. will be protein, 30 per cent. fat, and 60 per cent. carbohydrate. Children need a slightly larger amount of protein and manual workers also usually require more protein, in both cases to allow

for the increase in cell building. The soldier in training was given 12½ per cent protein, 25 per cent. fat, and 62½ per cent. carbohydrate.

The improvement of nutrition of industrial workers has been taken up widely in recent years. Factories have established canteens or dining rooms where the workers purchase a well-cooked, nourishing, digestible meal at cost. The "Final Report of the British Health of Munition Workers Committee" says, "The industrial canteen has, in fact, proved itself one of the most effective instruments in securing and maintaining a high standard of industrial work...it has supplied improved nutrition to the worker, which has led to a reduction in sickness and to increased energy, better time-keeping, and improved output."

Until about 30 years of age a healthy appetite may be indulged, so long as digestion is good and overweight not excessive. After the age of thirty years it is best for everyone, except those at hard labor, to consult the scale frequently and to keep the food intake below the amount which will cause overweight. Life insurance statistics have shown that men even ten pounds overweight are not as good "risks" as are those ten or more pounds under the standard. Joslin warns against obesity in an article entitled "The Prevention of Diabetes."

Primitive man probably took his food as do the beasts—raw. Civilized man requires that much of the raw material be changed by heat, to make it more digestible and more palatable.

Heat is applied directly to food as in baking and broiling, through the medium of boiling water or steam, or by fat at temperatures of 350 to 400° F, known as frying.

Any meat that is to be consumed should have the juices retained. It is therefore placed directly into great heat and the outer layers are at once coagulated, making a more or less impervious coating. If soup or broth is to be made, as much of the meat juice as possible should be extracted. The meat is then placed in cold water and the temperature gradually raised to the simmering point, 185° F., and that temperature is maintained for several hours. Eggs, milk, and cheese are easily digested when eaten raw. When cooked, heat at a low temperature should be applied for a short time only.

Vegetables, to retain their valuable mineral salts and as much carbohydrate as possible, should be cooked in the smallest possible amount of water. All cereals, except rice, require long cooking to soften their woody fibre. A fireless cooker for this purpose is excellent, as sufficient heat is applied for 4 or 5 hours.

When food is cooked in fat, the fat should be deep enough, and hot enough, to immediately coagulate the surface and thus prevent saturation of the food with grease.

Water.—A good water should be clear, odorless, and free from intestinal bacteria and harmful chemical substances, whether the supply be a well or spring for a farm house, or the public supply of a great city. An

abundance of good water should be available to all, not only for drinking, but for washing and cleaning purposes. The individual should drink 6 to 8 glasses a day, and, in hot weather, proportionately more to replace that lost in increased perspiration.

Clothing.—Sufficient clothing should be provided to prevent rapid heat loss, but it should be so chosen that the skin will be dry and allowed to exercise its heat regulatory mechanism.

The materials of which most clothing is made are wool and cotton. The advantages of wool are, that it is a poor heat conductor, and that it will absorb quickly a large amount of moisture. Its disadvantages are that it dries slowly, thus keeping the skin in a humid atmosphere, and that it is difficult to properly launder. Woollen underclothing then, except for outdoor workers in cold weather, would tend to keep the skin constantly moist and relaxed. Cotton conducts heat well, absorbs moisture comparatively poorly, but dries quickly. For the average indoor worker, who lives in summer temperatures most of the waking hours, cotton underclothing throughout the year is best. During the winter both indoor and outdoor workers should wear woollen outer clothing, and the indoor worker, when going into the open air, should add a heavy woollen or fur overcoat. In summer, in climates where the temperature is high, and marked diurnal changes not usual, the body may be clothed in cotton entirely, or in cotton underclothing with light woollen outer clothing. In other words all should dress for the temperatures in which most of the waking hours are to be spent, and add woollen overclothing when low outdoor temperatures are to be encountered.

For the foot covering the essentials are, that it keep the feet dry, and allow full free motion and circulation. The leather of shoes prevents any evaporation, so a sock or stocking should be made of the material which will best absorb moisture, *i.e.*, wool. It not only keeps the foot drier but acts as a pad between shoe and skin, preventing, to some extent, friction by the leather. The value of heavy woollen socks is well known to the soldier and to others who do much walking. Socks and stockings should be loose enough in the foot to avoid cramping of the toes. Of all the articles of clothing worn the sock should be the most cleanly.

A flat surface, held vertically against the inner side of a normal foot supporting the body weight, should touch the inner sides of the arch, the heel, and the full length of the great toe. The ordinary shoe pushes the great toe outward so that its distal end lies against the other toes and it is not allowed its full function. The impression made by a normal foot appears as if the anterior part were bent toward the mid line of the body. The sole of a proper shoe should fit this impression. The inner edges of the soles of a pair of shoes when placed side by side, should touch from the forward end of the shank to where the distal end of the great toe lies, then sweep widely outward beyond the little toe. The shank should be narrow, quite flexible, and should connect sole and heel along the outer side of the foot. The whole sole should be flat from side to side, and, from the shank

forward, should lie flat on the ground. The uppers should fit somewhat closely at the sides of the heel, and lace firmly over the instep and about the ankles, but from the vamp forward should be loose enough to allow the toes free movement. The inside length of the shoe should be $\frac{3}{4}$ inch longer than the foot when bearing the body weight.

In walking one should plant the foot parallel with the line of travel so that full advantage may be taken of the work of the great toe. A moderate "toe-in" habit is of value in the correction of mild degrees of flat foot.

Daily Habits.—EATING.—For the adult 3 meals a day are sufficient. They should be taken at regular hours and ample time should be allowed for their ingestion. Breakfast should be substantial, especially for those who do manual work. For young children, and for old people who can allow time to eat, and a period of quiet for digestion, the largest meal is best taken at midday. Adults who must take their midday meal away from home, or who cannot allow adequate time for its consumption, should have the largest meal in the evening, in spite of the fact that sleep is not as restful while digestion is taking place. Young children may well have a glass of milk, or bread and butter, between meals, or in the longest daytime interval between any two of them. The best change for the lowered heat expenditure of hot weather is made by including in the diet the fresh summer vegetables and eating less fats and starches. Protein should be at a minimum in hot weather because its specific dynamic action may raise the heat production as much as 40 per cent..

The teeth should be cleansed twice daily with a moderately stiff brush and some good dental powder or paste. Acid mouth washes, a teaspoonful of vinegar in $\frac{1}{2}$ glass of water, will prevent the formation of tartar and will remove the plaques of mucin under which caries of the tooth begins. Care in the cleaning and brushing of the gums and teeth is the best preventive of pyorrhœa. The dentist should be consulted every 6 months, whether there be symptoms of dental trouble or not. Any dental work, such as bridges and crowns, should admit of surgical cleanliness. Many poorly constructed dental fittings are the cause, in later years, of chronic abscesses which may seriously affect the health.

The bowels should move at least once daily. Constipation is probably the most frequent abnormality from which the human being suffers, and is most often due to faulty training. It is an important factor in lowering the general health and may be prevented by special attention to training. Occasionally, it is a symptom of some local or general morbid process.

An infant, long before it can walk or talk, may be trained to defecate at a definite time each day. Children should have some convenient time selected for them in which they must go to the water-closet, and, if there is not a successful movement, must report the fact. If, in spite of regular training, a child is habitually constipated, the feeding of more green vegetables and stewed fruits will usually regulate the bowels. A daily laxative should not be used without exhausting all other means of regulation, and then only upon the advice of a physician.

For every one a regular time for this duty should be selected and rigidly adhered to. A habit is then formed and the rectum accustoms itself to emptying at such an hour, and will give warning. The regular inclination disregarded for several days, soon breaks the habit and constipation begins.

Morning, either before or immediately after breakfast, is the best time for the daily stool. During sleep the slow action of the intestine has brought the waste material to the rectum. The activity of bathing and the body movements in dressing are stimuli which originate peristaltic waves. Breakfast is another stimulus, if one be necessary. In some individuals a glass of water, either hot or cold, immediately on rising, will be beneficial and some men require their after-breakfast cigarette or pipe.

Factors assisting in the correction of constipation are regular daily exercise, more water drinking between meals, on rising, and on going to bed, and a less concentrated diet in which foods containing more waste material, such as the green vegetables, the coarse cereals, and the fruits, are eaten. The maintenance of an erect posture is of assistance, the shoulders back, chin in, abdominal muscles taut, keep the stomach and intestines in their proper places.

Alcohol.—It is extremely doubtful if anyone ever claimed that the “hangover” is conducive to good business. The most harmful dosage of alcohol however, is that in which an amount is taken every day. Clinicians know that the chronic hospital case, in which alcohol is the probable causative factor, has been a moderate steady drinker, and is not the man who goes on an occasional spree. Life insurance companies, in the United States and in England, have collected statistics on the subject of alcohol ingestion, and have found that the man who takes some every day shortens his life in years depending upon the daily amount. Some large industrial organizations have prohibited the use of any alcoholic drink in their factories because of too frequent afternoon accidents. Athletes are forbidden its use during training. Many men, holding responsible positions in our high-pressure civilization, know that their business or professional judgment is not as good under the most moderate use of alcohol. The spirits bills of hospitals have been steadily declining for years, showing the trend of thought in the medical profession in regard to its use as a drug. Benedict found that it belongs to the narcotic drugs; that it depresses the lower reflex arcs of the spinal cord, and later, the higher nervous mechanism; and that it does not improve the circulation. Finally, when nations strip for a big fight, the effects of alcohol on efficiency are acknowledged. Russia prohibited the sale of intoxicating liquors entirely; England curtailed their sale greatly; in France it was against the law to sell distilled liquors to a man in uniform, and the United States prohibited the sale of any alcoholic drink to a soldier, and used its war power to remove saloons from the vicinity of training camps.

Alcohol has its place as a therapeutic agent and should not be discarded, as a drug simply because its excessive use as a beverage has deleterious effects.

SLEEP.—Adults require from seven to nine hours of sleep, women, as a rule, requiring more than men. Children should have considerably more than the adult, proportionate to the age, from the infant, who spends night and day sleeping and eating, to the child of fourteen to sixteen, who should have at least nine hours of sleep regularly. The most beneficial sleep is that at regular hours each night and is dreamless. One should wake refreshed. Worry, before going to bed, and the late supper are causes of disturbed sleep.

BATHING.—A warm bath with soap should be taken at least twice each week to rid the skin and its pores of the collected fatty material from excretion of the sebaceous and sweat follicles. For the daily bath, cold, or cool water, should be used, preferably by shower or sponge, and it should be followed by brisk rubbing with a coarse towel. If a reaction or afterglow is not obtained, the bather may stand in 6 to 8 inches of warm water, and then try the cool shower, or, he may start with a sponge wrung out of water at about 80° F. and, during several weeks, gradually reduce this temperature until the water is about 50° F. Chilliness or fatigue should not be the aftermath. Young children, old persons unused to cold water, persons with cardiac and renal disease, and women during menstruation and pregnancy, should not take cold baths.

WORK AND RECREATION.—The necessity of daily outdoor exercise for the office worker can scarcely be overestimated. All persons in sedentary occupations are too prone to limit physical exertion to getting to and from the office. This is a great mistake, for daily exercise keeps the muscles in better condition, improves the circulation, helps the skin to properly function, and assists the work of the gastro-intestinal and renal tracts.

Any exercise is best taken in the open air, and, if time allows, some recreation in the open air of the country once or twice each week is of great benefit in maintaining the health. For the man or woman over 40 years of age occasional violent games are unwise. They put too great strain upon an untrained heart and circulation; but walking, moderate swimming, horseback riding, and especially golf, are excellent. Many men are bored by simple exercise but will enjoy it when it is associated with an element of competition. Golf affords this, and, in addition, gives play to entirely unused muscles in walking about the usually uneven golf course.

The man who is unable to leave the city may easily walk a mile each day to and from his office. Rosenheim in England, estimating the energy expenditure of women in munition works, found that light work increased the heat production 72 per cent., hard work 181 per cent., and walking, on level ground at the rate of 3 miles an hour, 274 per cent.

No exercise should be carried to the point of exhaustion, nor should it be undertaken when physically fatigued.

Infections.—The 2 largest factors in poverty and physical disability from disease are the chronic infections, tuberculosis and syphilis. They were, in equal proportions, the cause of defects in 11 per cent. (about 80,000), of the men rejected by the draft boards. The prophylaxis and treatment of these diseases are taken up in the appropriate chapters.

During the past decade chronic focal infection has been widely discussed. It has been computed that 80 per cent. of all focal infections are in the head, mainly in the teeth and tonsils, and the remaining 20 per cent in the lungs, gastro-intestinal and genito-urinary tracts. The significance, as causal factors in many diverse conditions, of chronic abscesses at the roots of the teeth, chronic tonsillitis, and chronic infections of the prostate, appendix, or the genital tract of women can scarcely be overrated. In every patient with substandard health of obscure causation, the question of focal infection should be taken up, and a possible abscess carefully searched for.

Any of the acute infectious diseases may have far-reaching consequences. During their course, and in convalescence, the vital organs should be carefully watched, and, if there has been any damage, appropriate treatment should be instituted at once in the early stages of the disease. A complete convalescence should be insisted upon.

I.

TREATMENT OF THE SPECIFIC INFECTIONS.

I. ENTERIC OR TYPHOID FEVER.

SAMUEL BRADBURY.

Preventive Treatment.—A case of typhoid fever means that there has been infection from the stools or urine of another case, or from those of a carrier. Its occurrence is a commentary upon present day carelessness in the disposal of excreta, neglect in washing the hands before eating, and upon the habits of the fly.

The prevention of typhoid fever may be considered under three headings:

1. Destruction of every bacillus as it leaves its host, the patient—sick room prophylaxis.

2. Community sanitation.

3. Personal preventive measures.

Sick Room Prophylaxis.—Every physician, who has the care of a patient with typhoid fever, should assure himself that his patient will not become a focus for dissemination of the disease.

With the diagnosis of typhoid fever, the question of home or hospital care arises at once. In this disease, where so much depends upon the nursing care and attention, the patient has a better chance of recovery in hospital, and certainly, with hospital facilities for disinfection, there is less opportunity for spreading the disease.

Whether the patient is treated in the hospital or at home, whether there are trained nurses as attendants, or the nursing is done by one of the family, the physician should write his directions for disinfection of every source of possible spread of the disease, and make sure that these directions are understood and carefully carried out.

In hospitals, in the United States at least, typhoid fever patients are usually cared for in the medical wards. Where there are many, it is best to group them in one ward and assign sufficient nurses to properly attend them. They should have separate dishes and thermometers, separate bed pans, urinals, and apparatus for enemas, and separate wash basins for sponges and bath for tubbing.

If hospital treatment be impracticable, a large sunny room in the house should be selected and curtains, floor coverings, and unnecessary furniture removed. During fly time windows should be screened, and a fly net over the bed is not only a comfort to the patient but a precautionary measure as well. A nearby, separate bath room, in which the nurse may carry out her necessary duties in disinfection, is a great convenience. The family should not have free access to either room. There should be a separate set of dishes for the patient, which may be boiled after use, then washed and dried. Uneaten food should be burned. Food requiring

long cooking may be prepared in the kitchen and delivered to the nurse, but for articles which require only warming or short cooking, such as milk and eggs, an electric or gas plate is an advantage. Such things should be kept in a separate ice box to which only the nurse has access.

It is best to keep the attendant or nurse entirely away from any connection with the food supply of the household. She should be kept out of the kitchen, and it is extremely important that she do none of the family cooking. She should not eat her meals in the sick room. If it be necessary that she eat with the family, she should be careful to thoroughly disinfect the hands, immediately before coming to the table, by scrubbing in soap and water, and then soaking them for one minute in some disinfectant solution. Her dress should have elbow length sleeves; she should wear a gown over the dress, and when giving baths or sponges, a rubber apron. When giving an enema or irrigation, she should wear rubber gloves, and, after any handling of the patient, whether gloves be worn or not, she should disinfect her hands.

Other than the dishes, the following require disinfection, both in the hospital and at home—stools, urine, sputum, vomitus, bath and sponge water, bed and night clothing, wash cloths and towels, tubs and basins used for sponges, the bed pan, urinal, rectal tube and enema bag, and the thermometer.

DISINFECTANTS.—The best disinfecting agent is *heat*, applied as live steam or boiling water. In hospitals, it is advisable to have contrivances especially built for this purpose—hoppers into which steam may be turned, for the stools and urine, and autoclaves, or large hot water sterilizers, for other material.

In the home, heat, as a sterilizing agent, is impracticable, and chemical disinfectants must be used. Any chemical disinfectant which is selected, should be easily handled, relatively inexpensive when used in the quantities required, readily available in the ordinary pharmacy, and thoroughly reliable in killing typhoid bacilli.

The chemical disinfectants in ordinary use are chlorinated lime, one of the phenols, and bichloride of mercury.

Chlorinated lime (*Calx Chlorinata*, U. S. P., “chloride of lime,” bleaching powder) may be purchased in a convenient five ounce can. The contents of one can dissolved in one gallon of water will make a solution of about 4 per cent. strength. The solution may be freshly made daily, or more frequently if necessary, and the bottle containing it should be tightly corked. The United States Pharmacopeia requires that this substance have at least 30 per cent of available chlorine.

The most frequently used disinfectants of the phenol group are *carbolic acid* and *cresol*. Carbolic acid should be used in 2 to 4 per cent. solution. Cresol, or its official preparation, *Liquor Cresolis Compositus*, is more effective, and may be used in 1 to 2 per cent. strength. An ordinary wash boiler, three-fourths full, holds about ten gallons of water; thirteen fluid ounces (400 cc.), of either of these chemicals, in ten gallons of water, will make a 1 per cent. solution. A stick should be used, when possible, to

handle articles in the solution, to avoid the effect of the chemical on the hands. Neither will discolor nor destroy sheets.

Bichloride of mercury in tablets, one of which when dissolved in one pint of water makes a 1 to 1000 solution, is convenient and inexpensive. It is of no value for disinfection of the fæces, because it will coagulate the outer layers of albuminous material, and prevent access of the germicide to all parts of the mass. It will discolor white cotton material, and its action is somewhat slower than that of chlorinated lime and of cresol.

With the use of any chemical disinfectant, the solution must be sufficient in amount and allowed time in which to act, at least one-half hour, to be potent as a germicide.

The best disinfectants are chlorinated lime for the urine, stools, bath and wash water, and cresol for clothing and rubber articles.

Fæcal movements should be mixed at once, in the bed pan, with twice their volume of 4 per cent. chlorinated lime solution, covered to prevent access of flies, and allowed to stand for one hour. Masses should be broken up to allow the disinfectant access to all parts of the material. It has been suggested that unslaked lime be used for disinfecting the stools. A small amount of hot water is added to the fæces and then sufficient unslaked lime to make the mixture boil. The heat produced in slaking is maintained for a time sufficient to kill all typhoid bacilli.

To the urine is added an equal volume of the 4 per cent. chlorinated lime solution, the mixture being then kept in the urinal for one-half hour. When there is evident bacilluria, hexamethylenamine, in doses of 0.5 gm. ($7\frac{1}{2}$ grains) should be administered 3 times daily. If the urine be alkaline, sodium benzoate, in the same dosage, should also be given.

Bath water may be disinfected by adding one tin (5 ounces) of chlorinated lime, mixing well, and allowing the agent one-half hour in which to act upon the bacilli. Water used for sponging, or for the daily bed bath, should be sterilized by the addition of an equal volume of 4 per cent. chlorinated lime solution.

Sputum should be expectorated into tissue paper, or small pieces of cotton cloth, and immediately deposited in a paper bag kept for this purpose. Cotton and the wooden applicators used in cleansing the mouth or nose are deposited in the same bag, and bag and its contents are burned daily.

Bed sheets, towels, wash cloths, night shirt, etc, are soaked in 1 per cent. cresol solution for 1 hour, then rinsed and laundered as usual. Enema bag and rectal tube are kept in the same solution when not in use. They should be well rinsed before use. Rubber sheets may be rinsed or sponged off with 1 per cent. cresol solution and hung up to dry. The thermometer may be kept in a glass filled with 1 per cent. cresol solution and rinsed before use. Bed pan and urinal may be kept in the cresol solution when not in use.

When the bowels move or when the patient urinates, care should be taken that none of the excrement soils the bed. After either act, the external

genitals, or the anal and sacral regions, should be bathed with one-fourth per cent. cresol solution, then washed with soap and water.

DISCHARGE.—No case of typhoid fever should be discharged until the urine and stools have been proven to be free of typhoid bacilli by bacteriological examination. Many city and state boards of health require that this be done before releasing any patient from observation. They will supply directions and package for collecting and forwarding the specimen to the laboratory, and usually require the examination of three specimens, at intervals of several days, with negative findings, before allowing a case out of quarantine. The problem of the treatment of those persons who continue to harbor typhoid bacilli is considered under the section on the typhoid carrier. (page 34).

FUMIGATION.—When the case is terminated, the room, if in a private house, should be fumigated with formalin gas. A convenient method is as follows. Windows and doors, except that to be used for exit, are closed, and the cracks sealed with gummed paper strips. Closets are opened and their contents spread about the room. Then for each 1000 cubic feet of space to be fumigated, 75 grams ($2\frac{1}{2}$ ounces) of potassium permanganate are dissolved in 90 cc. (3 ounces) of hot water. To this solution, 30 grams (1 ounce) of paraformaldehyde are added in a dishpan set in a wash tub, the remaining door quickly closed and sealed, and the room left closed for 24 hours. The room should then be thoroughly scrubbed and may be repapered and painted. The mattress is best sterilized in an autoclave. It may be left draped over the foot of the bed when the room is disinfected and afterward given a days sunning.

Community Sanitation, or prophylaxis, is considered under the chapter on hygiene. Typhoid fever is a water and food-borne disease, and, for that reason, its elimination from towns and cities is almost entirely a problem of the health officer.

Personal Preventive Measures.—The application of present day knowledge of how to avoid the ingestion of typhoid bacilli takes precedence, in civilian life at least, over active immunization to typhoid fever. The careful oversight of water and of uncooked food, the hygienic and æsthetic habit of proper washing of the hands before eating, and the exclusion of flies from access to any food, are of primary importance in the personal avoidance of typhoid fever.

WATER.—Inhabitants of cities and large towns which are progressive enough to have low typhoid death rates, may safely drink the water supplied without further purifying process. Where the water supply is questionable, typhoid fever endemic, or during an epidemic, all drinking water should be boiled, or chlorinated in the strength of 1 gram of chlorinated lime to 40 gallons of water. The chlorinated lime should be fresh. It should be first mixed into a paste with a few drops of water and the paste then added to the water to be sterilized. Water so treated is safe to drink in one-half hour. Milk should be pasteurized.

VEGETABLES.—Fresh vegetables, especially those which are to be eaten raw, as celery and lettuce, should always be carefully washed in clean water. Fruit may be washed and the skin removed before eating. In Belgium, the Misses Champion and Van de Velde studied the effects of rinsing, and of soaking for one-half hour, in 0.2 per cent solution of chlorinated lime, on raw fruits and vegetables which were contaminated with colon bacilli. Rinsing removed most of the organisms, and the half hour soaking killed all the colon bacilli. The taste and smell of the vegetables was very slightly affected.

TRAVEL.—When travelling, any well known brand of table water may be used for drinking. If milk is necessary, a tin of one of the dried milk preparations is easily carried and the resulting mixture is satisfactory. Uncooked vegetables and oysters are best not eaten.

ANTITYPHOID INOCULATION.—For the man who is constantly travelling, the summer vacationist who does not know of the purity of the water, the inhabitants of communities during an epidemic, and when there has been direct contact with a case of typhoid fever, active immunization should be carried out.

Immunization to typhoid fever by inoculation with the dead germs of the disease is the main factor in the reduction of this scourge of armies. Sanitation is the lesser factor, but a quite important one. Because men have been immunized is no reason for neglect in the cleanliness of food and drink, in washing the hands before meals, and in keeping excreta away from the fly, and the fly away from mess.

In the recent war, during the years 1917, 1918, and 1919, there were, in the United States Army, 1523 cases of typhoid and the paratyphoid fevers, and 217 deaths from these diseases. The Surgeon General of the Army, speaking of the rates of 1917 and 1918, says, "... had the same rates prevailed as during the Spanish-American War and the Philippine insurrection, during the years 1898 and 1899, there would have been 291,637 cases and 30,916 deaths." Most of these cases in the recent war occurred in troops in Europe, and represent the effect of the wretched sanitation and grossly polluted water of the devastated areas, on the development of typhoid fever in immunized troops. The rate was low, but it was evidence that proper sanitary measures may not be neglected at any time if all typhoid fever is to be prevented.

Russell and Nichols put the problem tersely: "The protection is not absolute; some cases occur among the vaccinated, but their number is small. The results in the Army are fully as good, if not better than those obtained against smallpox with vaccinia."

The Kansas Board of Health says, "The protective value of antityphoid vaccination is no longer open to question. No more definite test could possibly have been given than that afforded by the recent war emergency, a test by millions."

The Vaccine.—The material used for antityphoid vaccination is the growth from an agar culture suspended in normal saline solution, or a

broth culture, of any one, or of all three of the typhoid group of bacilli, (*bacillus typhosus*, *bacillus paratyphosus A*, and *bacillus paratyphosus B*), standardized so that the approximate number of organisms in each cubic centimeter is known. It is sterilized, usually by heat, sometimes by the addition of a chemical, cultured for sterility, and a preservative added. Such a suspension of bacteria is known as a vaccine. Various types of vaccine have been suggested and tried—sensitized living vaccines, dead bacilli suspended in oil called lipovaccines, the dried and ground sediment of typhoid cultures, etc, but the suspension of killed bacilli in normal salt solution is most widely used and gives satisfactory results.

Mixed Vaccine.—In the recent war France and England at first used vaccines made of typhoid bacilli only. Upon the development of paratyphoid fever in the armies, vaccines were made of suspensions, in varying strength, of all three typhoid group bacilli and these were called triple or “TAB” vaccines. When the United States entered the war men were immunized to all three fevers, though the vaccines for typhoid and for the paratyphoid fevers were given separately. This made 6 injections necessary and protracted the series greatly, and the vaccines were combined. Later Davison found that the immunity obtained by the administration of mixed typhoid and paratyphoid vaccine is at least as good as, and often greater than that obtained against any one of these organisms when it is employed alone for a first immunization.

The paratyphoid fevers are probably as widely spread, but are not as frequently encountered as is typhoid fever. The attack of paratyphoid fever is not as severe, and the mortality is not as great, but there is little difference in the duration of the disease. One has, therefore, less chance of contracting the disease, and less chance of death, but will be disabled for nearly the same length of time.

It has been found that doses of the mixed vaccine do not cause a more severe reaction than that caused by doses of any one of the bacilli alone, so it appears more practicable to immunize against all three organisms in one series of injections.

Dosage.—Two or more injections are given for each immunization because a better immunity is produced with less reaction for any one dose, than when one large dose is injected. The immunity produced appears to have a direct relation to the total number of bacilli injected.

The usual dosage in the United States follows that advised by the Army. This is a series of three injections, the first of which contains 500 million typhoid bacilli, and of the paratyphoid bacilli, A and B, each 375 million. The second and third doses each contain 1000 million typhoid bacilli, and 750 million of each of the paratyphoid bacilli. Many of the commercial preparations are made up in the same strength as that of the Army vaccine for the typhoid bacillus content, but contain smaller doses of the paratyphoid bacilli. Dreyer, of England, believes that the “TAB” vaccine should be made of equal proportions of each organism, and that

this should be 500 million for the first dose, and 1000 million for the later dose or doses. He finds no greater reaction with the increased dosage.

Administration.—The vaccine is given hypodermatically with a sterile syringe and a sterile fine pointed needle. The best site for the injection is the upper arm at the insertion of the deltoid muscle. Care must be taken that the fluid is injected into the subcutaneous tissue, and not into a vein, the muscle, or the skin. The skin at the site of the injection should be scrubbed with alcohol or swabbed with iodine before the needle is inserted.

The best time for the injection is in the late afternoon, as the patient is then able to keep relatively quiet, and the reaction, if there be one, will occur at night. The injections, to produce the highest immunity, are given at intervals of seven to ten days, but the interval may be less or greater, and good results obtained. Frequently it is necessary to complete the immunization in as short a time as possible, and it is then well to remember that the three injections may be given, at five day intervals, in a total time of eleven days.

Children two years of age and older stand the immunization well and should be re-vaccinated every two or three years. The dose for a child is estimated at the fractional relation its weight bears to the adult average, one hundred and fifty pounds—a child of fifty pounds, for instance would receive one-third of the adult dose. Adults exposed to the disease should be vaccinated yearly. The British Army required that every soldier have one full dose of the triple vaccine at the end of each year after the completion of his first immunizing series.

Reaction.—The reaction is local and general. The local reaction is an area of swelling, heat, redness, and tenderness about three inches in diameter which subsides in twenty-four to sixty hours. It may be much larger, involving the whole upper arm, and may even fluctuate, but will eventually subside. The general reaction is usually a feeling of lassitude, sometimes with mild frontal headache. There may be no reaction at all, or it may be severe, with fever, prostration, severe headache, nausea and vomiting, diarrhoea, and occasionally albuminuria.

Women are said to be more liable to reaction than are men. Individuals who have low resistance to any infection, or who suffer from chronic disease, are more likely to have severe reactions. When a severe reaction is feared, on account of the general condition, the first dose may be reduced to 250 million, or even 100 million typhoid bacilli, with the other organisms in proportion, and four or five injections given, the later doses being increased, up to double the previous dose, depending upon the reaction observed.

Contraindications.—The main contraindication is chronic kidney disease. The series of injections should not be started during an acute illness until the temperature is normal. Whenever possible, women should have the series of injections during the intermenstrual period. Women in early pregnancy may be immunized, but during the last one or two months, the

series of inoculations is best postponed. Tuberculosis of the lungs is not a contraindication, as neither typhoid fever, nor typhoid vaccination, appear to have any harmful effect on this disease.

Complications.—Randolph says that, according to evidence from the Walter Reed Hospital, in rare instances, latent infections, especially streptococcus and tuberculosis, may be made active by vaccination. In very rare instances there may be acute or even fatal reactions of an anaphylactic type. Bussy in France, and Fernandez in Cuba, have reported cases of corneal herpes which were apparently associated with antityphoid vaccination. Others report isolated instances of various types of nervous diseases and of stomach disturbance which appeared to be associated with typhoid vaccination. In the early days of the war I assisted in the immunization of a regiment of 1200 men. Each man had six injections of vaccine. But one man was given “quarters” after any dose of the vaccine. He was a chronic alcoholic, and, the evening after the first injection, had a convulsion of epileptiform type. He had no trouble with the remaining injections and no further convulsions.

The duration of immunity is quite variable. In the review by Vaughan, of 373 cases of typhoid fever occurring in immunized soldiers, thirty-three developed typhoid fever within the first month after inoculation, forty-nine during the second to fifth months, and seventy-three from the sixth to the tenth months. I have seen four cases of typhoid fever develop within five months after inoculation. In quoting such figures it should be remembered that these cases represent a rate of less than 1 in each 1000 soldiers, that all of these men were exposed to extremely insanitary conditions, and many of them to physical exhaustion. The disease in these cases is usually ascribed to a heavy infecting dose of bacilli.

On the other hand there is good evidence that, in the men who were of draft age during the war, typhoid fever has been considerably less frequent during 1919 and 1920, than in women of the same age group. For 1919, the Metropolitan Life Insurance Company finds that the death rate for typhoid fever, in men twenty to thirty-five years of age, was 64 per cent. below the rates of 1911 to 1916, while the rate for women of the same age group, was only 47 per cent. below the rates for the same previous years. In the typhoid fever epidemic at Salem, Ohio, in the fall of 1920, it was found that there were relatively few men between twenty and thirty years of age who contracted the disease. An investigation of the ex-soldiers in the community showed that they numbered 210, and that only three of them had typhoid fever, an incidence of one in seventy. Of the entire female population between twenty and thirty years of age, one in every eight had the disease. The records of the dates of immunization of all ex-service men were collected by the American Legion, and it was found that all had been immunized for more than two years and some for more than three years. Such figures point to the fact that, for at least two years, there persists, in the mass of men inoculated in the Army, a considerable degree of immunity.

Typhoid Fever in the Immunized.—That the severity of the disease, or the mortality, is lessened in immunized individuals may be questioned. Vaughan cites a mortality of 13 per cent. in 1,242 cases of typhoid fever, which occurred in the American Expeditionary Forces between July 1, 1918, and May 31, 1919. He also states that the disease, seen in the immunized soldier, was similar in severity and symptoms to classical typhoid fever, but that, up to the eighth month after inoculation, it was not as severe, nor as fatal, as after the eighth month. Such a rate, 13 per cent. is considerably higher than that of the Spanish-American War, and than that in large civilian series of cases collected over a number of years. However, Gautier and Weissenbach state that in 1914, during the first three months of the war, and before the French Army was entirely inoculated, the mortality from typhoid fever was 37.5 per cent. and later, when there were cases of paratyphoid fever, and still in uninoculated men, it was 20.25 per cent. If the two series of figures, with the discrepancy in the years of infection may be compared, it would appear that the disease was rendered less severe by the inoculation. In comparing figures for rates in civilians and those for soldiers under war conditions, it must be remembered that the soldier is at a disadvantage in that he does not receive the essential early care, and is often physically exhausted when turned over to the medical authorities.

Treatment.—General Considerations.—The problem in the treatment of a case of typhoid fever is that of supporting the patient through a long, severe, general infection. In this disease, more than in any other, a well-trained, hard working nurse, a careful sufficient diet, hydrotherapy, and the proper management of the many minor details, are the determining influences in the recovery of the severe case.

The patient should be put to bed at once and kept there until well into convalescence. The bed should be single width, about the height of an ordinary table, and the spring should sag very little. A moderately firm hair mattress, covered with a quilted pad, and a rubber blanket beneath the sheet and draw sheet, is best. All mattress coverings should be perfectly smooth in order that wrinkles may not annoy the patient. Bed clothing should be light but of sufficient warmth to keep the patient comfortable, and it should not be drawn and tucked in tightly over the body and especially over the feet. It may be advisable to use a cradle across the foot of the bed to prevent pressure of the bed clothing on the toes. The pillow should be single.

The patient must be spared all exertion. The use of bed pan and urinal should be insisted upon from the beginning, and the patient will soon accustom himself to them. Visitors should be limited to the most intimate members of the family, and their visits must be brief. The stuporous patient is often better without visitors.

In men the hair should be cut short at once—the patient is more

The general management of typhoid fever has been gone into more extensively than that of the other infectious diseases. In any long continued infection, the nursing, which is so essential to recovery, may be patterned upon it.

comfortable and the scalp more easily cared for. In women, if the case be severe, it is probably best to cut the hair. If not cut, it should be gently brushed and arranged in two plaits.

Temperature, pulse, and respiration should be taken at regular intervals during each twenty-four hours. The interval is usually four hours, but, if baths be given, many physicians prefer a third hour temperature. A chart should be kept upon which temperature and pulse are plotted. The physician should take care that, as far as is possible, feeding, medication, and hydrotherapy be given at the time when the temperature is taken, and the patient thus disturbed as little as possible.

The mouth requires special attention to prevent the dry tongue, and a collection of sordes on teeth, lips, and cheeks. Neglect in this may cause ulceration of the gums or throat and infection of the salivary glands. Tongue and teeth should be carefully cleaned after each feeding. Patients who are not stuporous may be allowed chewing gum. As a mouth wash, normal salt solution with one-half teaspoonful of bicarbonate of sodium to the glassful may be used. Osler recommends a saturated solution of boric acid with 10 per cent. glycerine and 1 per cent. carbolic acid. The formula suggested by Wadsworth appears to be efficacious:—

R Sodii Chloridi.	8.00	℥ ii
Sodii bicarbonatis.	3.00	grs. xl
Aquæ destillatæ.	240.00	℥ viii
Glycerini.	120.00	℥ iv
Alcoholis.	600.00	℥ xx
Thymolis. . . . .	.....	.....
Mentholis a.a.	0.30	grs. iv
Ol. gaultheriæ.	0.80	m. xii
Ol. cinnamomi.	0.50	m. viii
Ol. eucalypti.	1.40	m. xx
Tinct. cudbear.	24.00	℥ vi
Tinct. krameriæ.	8.00	℥ ii.

M. Ft. mistura.

Signa. Dilute with 3 or 4 parts of water and use as a mouth wash and gargle.

The nasal cavities may become blocked with dried crusts or the blood from epistaxis, and force the patient to breathe through the mouth. A mild alkaline solution should be used in an atomizer twice daily. At times it may be necessary to loosen the crusts with oil and extract them with forceps.

BATHING.—The hands and face of the patient should be washed morning and evening, and the hair should be brushed. The patient should have a daily cleansing bath with soap and water, followed by an alcohol rub. This necessity keeps the skin in better condition and prevents the onset of superficial infections. A simple tepid water sponge in the evening followed by gentle rubbing of the back will often act as a somnifacient. The cleansing of the buttocks and sacral region after defecation has been mentioned. The sacral region should be kept dry, and is best powdered with a good talcum or stearate of zinc. It is well to rub the skin over the sacrum several times daily to keep the local circulation in good condition and prevent bed sores. Other bony prominences, upon which there is pressure should

receive the same attention. The patient should not be allowed to lie in any one position for hours at a time. He should be turned from side to side at intervals and propped over part way with pillows. This helps prevent the development of hypostatic congestion and of bed sores.

Diet.—In modern times, Graves, about 1840, was the first to give any food to fever patients. His gruel broth diet contained about 300 calories daily. From then until the close of the century, the usual diet in typhoid fever was liquids, milk, various meat broths, and egg albumin water. About the end of the century several prominent physicians, Shattuck and Flint in this country, and Bushuyev in Russia, advocated more food and gave their patients toast, butter, crackers, eggs, gruels, soft puddings, apple sauce, macaroni, and even boiled meat, and all remarked the lessened toxicity and lower mortality.

In 1909 Shaffer and Coleman studied the metabolism of typhoid fever patients. Their work indicates that a sick adult expends about forty calories per kilogram of body weight, while the expenditure of the normal adult at rest in bed is twenty-six calories per kilogram. The increase is mostly accounted for by the fever, which is actually burning the patient up at a more rapid rate than normal. If this increased caloric requirement be not met by food, the patient draws upon his body tissues for the energy requirement, and, for this reason is so emaciated when convalescent.

HIGH CALORY DIET.—As suggested by Coleman, the high calory diet is simply an attempt to satisfy the daily expenditure of energy. In working out these diets, Coleman and Shaffer found that typhoid fever patients continued to lose nitrogen (and weight) until the energy value of the food eaten amounted to 50 per cent. to 100 per cent. above the heat production, and therefore estimated that, to prevent loss of body weight, typhoid patients should have sixty to eighty calories per kilogram of body weight—from 4000 to 5500 calories for a 150 pound adult a day. The high calory diet then aims at giving this amount of nourishment, *subject always to the desires of the patient, and to the condition of his stomach, digestive tract and bowel movements.* As a matter of practice they found that, during the first two weeks of the disease, few patients would or could take more than 3000 calories per day. In 1912 Du Bois confirmed the work of Coleman, and further, demonstrated that typhoid fever patients absorb suitable protein and carbohydrate as well as do normal individuals, but that fat, especially in the early part of the disease, is not absorbed as well.

In all cases, in the selection of the food to be given, four factors must be considered—digestibility, absence of harmful residue, caloric value and palatability. These factors satisfied, the amounts of food to be given to the individual patient must be prescribed as one would the milk mixture of an infant, and the effects of feeding, on the stomach, abdomen, and stools are to be as carefully noted.

Milk.—Plain whole milk is the basic ingredient of the high calory diet. It is easily digested, is usually well taken if not the sole article of diet, and very few persons have any real idiosyncrasy to it. The average patient may

take one to one and one-half quarts a day. Too much milk will cause bulky stools, curds, diarrhoea, and tympany.

Protein.—A relatively large amount of protein appears necessary, estimated by Coleman at about sixty to ninety grams per day. One-half of this amount may be supplied by four to six eggs daily, the remainder by the protein of milk and that in cereals. Broths and beef-tea contain a small amount of nourishment, and are almost wholly made up of the extractives of meat, which may irritate the kidneys. Meats are not easily digestible. Both are best omitted.

Fats.—Cream, butter, and egg yolk are most easily taken. During the early part of the fever they may not be digested well.

Carbohydrates.—Toast, cereals, and the juices of some fruits are valuable—but sufficient to supply the nourishment required would give too much bulk for the patient to eat. Therefore a sugar was selected. As cane sugar is too sweet to be taken in any quantity, lactose (milk sugar), which has relatively little taste, was selected. Lactose forms no essential part of the diet, but is simply an easily digestible, relatively tasteless, pure carbohydrate, which leaves no residue.

When first seen the patient is usually given plain whole milk, six to eight ounces every four hours, for a day or two, until one may learn of the probable severity of the case. Then, if it appear mild, a varied diet is given. If the case be toxic and stuporous, the patient unable or unwilling to take food, the diet is limited to liquids and eggs.

Liquids.—The liquid feeding consists of a mixture of milk, lactose, and cream. Milk one quart, cream fifty cc. ($1\frac{2}{3}$ ounces), and lactose fifty grams ($1\frac{1}{2}$ ounces) will supply 1000 calories. Milk $1\frac{1}{2}$ quarts, cream one pint, and lactose 480 grams (16 ounces) will furnish 3900 calories. Between these extremes any one of the ingredients may be changed to suit the requirements of the individual. As a general rule, in the early part of the disease, lactose may be increased more rapidly than is the cream. These liquid mixtures are usually divided into eight equal portions, and one portion is given every three hours during day and night. Coffee may be used as a flavoring agent if desired, and for one of the feedings lemonade, sweetened to taste with lactose, may be substituted. To increase the protein during the period of liquid nourishment, eggs are used. They may be taken raw and beaten up in one of the milk feedings, or they may be soft cooked (coddled), and eaten with butter and salt.

The following table of foods, with their caloric values, suitable for the varied diets, has been adapted from Coleman:

ARTICLE	GRAMS	HOUSEHOLD MEASURE	CALORIES
Apple sauce	30.	heaping tablespoonful	30
Bread	30.	average slice	80
Butter	10.	1 pat	80
Cereal, cooked	45.	heaping tablespoonful	40
Crackers	9.	1 soda	36
Cream, 20 per cent	30.	two tablespoonfuls	60
Egg		1 whole	75
Egg white		of one	15

ARTICLE	GRAMS	HOUSEHOLD MEASURE	CALORIES
Egg yolk.....		of one.....	60
Milk, whole.....	475	1 pint.....	320
Potato, whole.....	100	1 medium.....	100
Potato, mashed.....	35	heaping tablespoonful.....	35
Rice boiled.....	30	heaping tablespoonful.....	60
Sugar, cane.....	13.5	level tablespoonful.....	56
Sugar, milk.....	18	1 ounce in med. glass.....	72
Toast.....		average slice.....	80

Combinations of the foods in the above list should be made. Such articles as milk toast, custard, ice cream, junket, bread and rice puddings without raisins are agreeable. They may be flavored with coffee, cocoa, caramel, or vanilla, and lactose added to sweeten to taste.

For the mild cases, and for the severe ones as they begin to ask for food, the following supplies about 3900 calories:

AT 7 A. M.	CALS.	AT 11 A. M.	CALS.	AT 5 P. M.	CALS.
Egg 1.....	75	Egg 1.....	75	Egg 1.....	75
Toast, 1 slice.....	80	Mashed potato, 20 gm. 20		Cereal, 3 tblsp.....	150
Butter, 20 grams.....	160	Custard, 120 gm.....	250	Cream, 60 cc.....	120
Coffee with cream,		Toast, one slice.....	80	Apple sauce, 30 gm.....	30
60 cc.....	120	Butter, 20 grams.....	160	Tea with cream, 90 cc.....	180
Lactose, 20 gm.....	80	Coffee with cream, 60 cc. 120		Lactose, 20 gm.....	80
		Lactose, 20 gm.....	80		
	<hr/> 515		<hr/> 785		<hr/> 635

and at 9 A. M., 1, 3, 7, 10 P. M., and at 1 and 4 A. M. a feeding of:

{ milk, 180 cc. 120 cal.)	} 7 feedings = 1960 calories.	(30 gms or cc. = 1 oz.)
{ cream, 60 cc. 120 cal.)		
{ lactose, 10 grams, 40 cal.)		

The sample menu above may have its caloric value increased, if desired, by the addition of an egg at any one or all three meals, of toast, with or without butter, or by the use of more lactose, or of more cream, or both, in the milk mixture.

As the patients ask for food, an effort should be made to satisfy the appetite and provide a menu of which the patient will not tire, and which will not upset the digestion. Abrupt increases in diet are unwise—but one article should be added at a time. To wake a patient, who is doing well and sleeping quietly at night, for any reason seems irrational, but no harm is done by disturbing the stuporous patient either for feeding or temperature at any time.

Coleman says that nearly all digestive trouble in typhoid fever is due to faults in the feeding. There may be trouble with the stomach, nausea or vomiting, or tympanites, or diarrhoea. Any of these may be due to too rapid increase in the feeding, to too large an amount of fat, or of milk sugar, or to individual food peculiarities. Vomiting without nausea is usually due to too much lactose. A mixture with too much cream, and perhaps a raw egg, may cause nausea and vomiting.

Most patients on high calory feeding have moderate abdominal distention which may be ignored. If the distention be excessive, the diet is at

fault. There is too great a total amount, too much fat, or too much carbohydrate. An excess of lactose is the commonest cause. Reduction of the food at fault will correct the distention at once.

Diarrhœa is usually due to too much cream, but it may occasionally be due to an excess of lactose. It is rapidly controlled when the offending article of diet is properly adjusted.

The advantages of a high calory diet, according to Coleman are:—the severe nervous symptoms do not occur; the patients lose little weight; convalescence is much shortened; tympany and diarrhœa are less frequent and are due to faults in the feeding; hemorrhage is not lessened, but the mortality from it is much reduced; there are fewer perforations, and the general mortality is considerably lower.

OTHER DIETS.—A number of physicians who have had a large experience with typhoid fever limit the diet considerably below that outlined above. Very few still limit the food to liquids, but allow toast, strained gruels, meat juice and thickened soups, usually one of each once daily, besides one or more quarts of milk. In no case of typhoid fever can a routine diet be prescribed—it must meet the needs of each patient and must be ordered with a large degree of common sense.

A week after the temperature is normal small amounts of chicken and finely chopped beef may be allowed and a gradual return be made to vegetables.

Water.—An abundance of water, is almost as necessary for the patient as is the food, and its administration has been well termed internal hydrotherapy. The amount should be prescribed and may be set at a minimum of two quarts in each twenty-four hours. A larger amount is beneficial, and it is a good plan to keep a supply at the bed side, with a feeding tube so arranged that the patient may help himself. The nurse should give water to stuporous patients at least every hour. Plain water, either iced or at room temperature, is best. It may occasionally be flavored with lemon and a little sugar, or small amounts of carbonated water may be used. A large amount of fluid by mouth causes polyuria and, in its passage through the body, takes with it toxins of the disease, and products of the increased tissue waste. Large amounts of water help to lower the fever, and to make the disease less severe.

Hydrotherapy.—Water, externally, will be utilized in some manner in nearly every case of typhoid fever. The nervous symptoms of the disease—stupor, delirium, coma vigil, and muscular tremor, are the outstanding indications for hydrotherapy, and it is in the improvement of these toxic symptoms that the benefit of the proper application of one or another method of hydrotherapy is most evident. Efficient hydrotherapy will also cause increased diuresis, a rise in blood pressure, an improvement in the circulation, deeper breathing during the treatment at least, and improved condition of the skin. Early in the disease, little or no effect may be noted in the temperature; later, the fever usually averages a lower range, probably only as a response to lessened toxicity.

In hospital routine hydrotherapy is instituted whenever the temperature, taken every three or four hours, reaches a certain point, usually 102.4°F . In most cases this degree of fever is a satisfactory indication, but patients are frequently very stuporous when the temperature is lower, even 101°F ., or may not appear at all toxic when the temperature is higher, 103 or 103.5°F . The patient should be carefully observed in this respect and hydrotherapy ordered for symptoms, not fever. Hydrotherapy should be used at the toxic temperature, and, in each individual, this is approximately the same throughout the course of the disease.

Physicians who have used the high calory diet extensively claim, that with proper feeding, hydrotherapy is not necessary, that its principal indication, marked nervous symptoms, do not occur, but that if cool water sponges are agreeable to the patient they may be given.

The best methods for the application of hydrotherapy are the bath, the drip sheet, the cold sponge and the cold pack.

THE BATH.—Efficient tubbing, in hospitals where it has been used in all cases, has resulted in lowering the death rate four to seven per cent.

A loin cloth is arranged, and the patient, lying upon a sheet and covered with a blanket, is taken upon a wheeled stretcher to the tub. There, sheet and blanket are removed, an ice cap or cold water compress placed upon the head, and the patient is lifted gently into the tub. The tub should be long enough to allow of submersion except the head, and should have canvas supports so arranged that the patient will be comfortable. The attendants then rub the entire body surface, except the abdomen, constantly while the patient is in the water. They should pay particular attention to the hands, feet, and back. The first few baths are best given with the water at 85°F ., and this temperature is reduced, in later baths, to 75 or even 70°F ., whichever temperature best suits the patient. They may be begun with the water at 85°F ., and the temperature lowered, during the bath, by adding iced water or pieces of ice. The time in the bath is ten to twenty minutes, depending upon the reaction. At the end of the prescribed time the patient is lifted out, wrapped in a dry sheet and a blanket and put in bed. Blueness and shivering are not serious, either in the tub, or if continued for some time afterward. After ten to fifteen minutes in bed the wet sheet is removed, the patient rubbed dry, and gown and bed clothing are replaced. Three quarters of an hour after removal from the bath the temperature is taken. While in the tub, or immediately after removal therefrom, the patient may have a drink of hot milk or broth. Whiskey is not necessary.

Contraindications to tubbing are peritonitis, hemorrhage, phlebitis, severe abdominal pain, or marked prostration. Old persons and children do not, as a rule, stand tubbing well.

The objections to the bath treatment are that it requires at least two attendants and a great deal of work and time—considerably more than can be afforded in many hospitals. The practice of waiting until a patient is in

desperate condition, and then beginning the bath treatment is unfair to both the patient and the treatment.

THE DRIP SHEET.—This does not require so much material, and is quite efficient in controlling toxic symptoms. A large rubber sheet is arranged, beneath the patient, to cover the entire bed. Its sides are then rolled up or propped up with rolled blankets, and the end at the foot of the bed so arranged that it resembles a trough draining into a wash boiler. The bed is then raised at the head, the patient uncovered, and water at a temperature of 60° F, or lower to iced water, is plentifully sprinkled over the entire body (an ordinary garden watering pot is best), while the attendant constantly rubs the limbs and chest and splashes water from the trough over the patient. This is continued for ten to fifteen minutes, the patient dried, the rubber sheet removed and gown and blankets replaced.

THE COLD SPONGE is considerably milder, but, where well applied, is efficient in the usual case, and requires but one attendant. It is especially useful in old persons and in children. A rubber sheet is placed beneath the patient, an ice bag or cold water compress on the head, and a towel, wrung out of iced water, in each axilla. For the sponging it has been customary to use a small amount of alcohol in the water but plain water, iced, is as good. Usually one limb at a time is sponged, rubbing toward the trunk, with a sopping wet wash cloth or sponge, then the chest and finally the back. At least one-half of the time allowed for sponging should be spent upon the back. Sponging is usually continued for 15 to 20 minutes.

THE COLD PACK.—The bed is covered with a rubber sheet and then a blanket. One or two sheets are then wrung out of water at 65° F. and spread upon the blanket. The patient is placed upon these and the edges of the sheets are folded over him closely, with the blanket outside of this. The patient remains in the pack one-half to three-quarters of an hour.

Drug Therapy.—There is no specific drug for the treatment of typhoid fever. The use of antipyretic drugs is unwise as they are often depressing to the circulation. The fever is but a symptom and is best controlled by careful attention to details in the general care, diet and by hydrotherapy. The intestinal antiseptics probably do no harm. Their use is based upon the idea that the disease is a local infection of the intestines. Phenyl salicylate is the best of this class of drugs, and may be used in doses of 0.3 grams (5 grains) every four hours, as a powder in capsules. The use of hexamethylenamine for its germicidal effect upon the urinary tract has been discussed.

Treatment of Special Symptoms.—*Epistaxis* may be profuse and troublesome. Cold applications to the nose, or adrenalin locally will usually control the bleeding, but it is occasionally necessary to pack the posterior nares.

Bronchitis, as a rule, requires no special treatment. If severe, some sedative expectorant may be given, such as *pulvis ipecac et opii* in doses of 0.03 gram (one-half grain), every four to six hours.

HEADACHE.—For the early mild headache, the ice bag or a cold compress to the head will usually suffice. More severe headaches will, as a rule, yield

to acetylsalicylic acid 0.5 gram ($7\frac{1}{2}$ grains), or pyramidon 0.13 gram (2 grains,) either of which may be repeated every four hours. For the intense headache of meningismus or meningitis, morphine sulphate is required. Lumbar puncture, allowing the fluid to run as long as it is under pressure, is of great benefit, and will often quiet the associated restlessness and delirium.

DELIRIUM.—Efficient hydrotherapy will usually control delirium most effectually. An ice bag to the head and plenty of water internally help to relieve this symptom of toxicity. In marked delirium a hypodermic injection of morphine sulphate, 0.015 gram ($\frac{1}{4}$ grain), is advisable. In milder cases, sodium bromide, 0.3 to 0.6 gram (5 to 10 grains), or chloral hydrate, 0.3 gram (5 grains), repeated every four hours will suffice. Many delirious patients, especially those with coma vigil, are greatly benefited by five to six hours sleep, and this is best obtained by the hypodermic administration of morphine sulphate. The delirious patient should never for a moment be left alone, as he may at any time manifest suicidal tendencies. For extremely restless patients, side boards, or a strip of canvas pinned securely along the sides of the bed, should be used. A restraining sheet should be used for patients who insist on getting up, and its use is usually less exciting to the patient, than control by the nurse. An ordinary sheet is folded once lengthwise and laid across the patient, extending from the chin to the hips. The ends are then pinned, or tucked under the side boards of the bed in such a manner that the sheet does not press too heavily upon the patient.

INSOMNIA.—The nurse may often best manage this by a warm sponge and gentle rubbing of the back an hour before sleeping time. If persistent, small doses of barbital, 0.2 to 0.3 gram (3 to 5 grains), may be given in the evening.

SEVERE TOXÆMIA.—The maintenance of free water drinking, up to three and four quarts daily when the patient can be persuaded to take it, is the best preventive. Water may also be given by rectum as normal saline solution, either by the continuous drip method, or in amounts of 200 to 300 cc. (6 to 10 ounces) given slowly every four hours. Sterile normal salt solution, 0.8 per cent. sodium chloride in distilled water, may be given under each breast, in amounts of 500 cc. (1 pint) twice daily. The intravenous infusion of salt solution, unless there be an acute emergency, is unwise, as the sudden addition of fluid to the blood volume may put too great strain upon a weakened heart.

METEORISM.—In patients upon the high calory diet a slight or moderate amount of abdominal distention may be expected, and need cause no anxiety. Marked distention is usually due to a fault in the diet. If the patient is taking much lactose it should be stopped and, if tympanites is not then relieved, the diet should be reduced to albumin water and water. If the distention be in the stomach the passage of a stomach tube gives instant relief. If the large bowel be affected, the rectal tube, passed gently for a distance of about fifteen inches will aid in the expulsion of the gas. A simple

enema, to which 30 cc. (1 ounce) of turpentine have been added, is sometimes effective, as is an enema of water in which four grams (1 dram) of alum has been dissolved.

Stupes.—When the distention is in the small intestine a properly applied turpentine stupe is the most generally useful treatment. They should be applied every twenty minutes or one-half hour. A strip of flannel about eighteen inches wide is passed beneath the patient. The skin of the abdomen is lightly greased with vaseline. Then a pad, 12 to 16 inches square, of several thicknesses of thin flannel, is wrung out of hot water to which turpentine has been added in the strength of one dram to the pint. This is closely applied to the abdomen and the ends of the flannel strip folded over it. A folded, dry, bath towel outside of the flannel will retain the heat for a longer time.

Hypophysis sicca U. S. P. (posterior lobe of the pituitary body), in a standardized solution for hypodermic administration, may be given in doses of 0.5 cc. (8 minims). Physostigmine (eserine) salicylate in doses of 1 mgm. ($\frac{1}{60}$ grain), given hypodermatically, is occasionally useful.

THE BOWELS.—*Constipation.*—Throughout the disease in many hospitals an enema of salt solution, or of soap suds, is given every day or every second day, in the absence of a natural movement of the bowels.

Early in the disease, before the establishment of the intestinal ulceration, the patient may be given a course of calomel followed by a mild saline.

Diarrhœa may be usually controlled by a change in the diet. In cases where this is not effective, the food may be omitted entirely for twelve to twenty-four hours, or limited to albumin water. In a number of instances it has been found that diarrhœa has been due to a secondary infection in the intestine from impure milk. If medicine be necessary, large doses of bismuth subnitrate, one to two grams (15 to 30 grains), may be given by mouth every 3 hours. It may be combined with 1 cc. (15 minims) doses of paregoric. A mixture of tincture of krameria 1 cc., (15 minims), bismuth subnitrate one gram (15 grains), and compound chalk mixture 4 cc. (1 dram), may be effective.

On the high calory diet the stools have a normal appearance and consistency, and there may be three or four every day.

CIRCULATION.—The blood pressure, and the pulse rate and quality should be carefully observed. When the rate rises to 120 or more, and the first sound of the heart is weak, some form of stimulation should be started. Tincture of digitalis may be given in doses of 1 to 2 cc. (15 to 30 minims) twice or three times daily. Strychnine sulphate is usually given in doses of 1 to 2 mgm. ($\frac{1}{60}$ to $\frac{1}{30}$ grain) or more every three hours. Whiskey or brandy may prove helpful in doses of 8 to 16 cc. (2 to 4 drams) every four hours. Camphor 0.13 gram (2 grains) in oil is useful in sudden collapse. If the blood pressure be continuously low, ninety or even seventy-five systolic, epinephrin should be given hypodermatically. The starting dose is usually 0.3 cc. (5 minims) every 3 hours. Later 0.6 to 1 cc. (10 to 15 minims) daily may be used. Hydrotherapy properly applied is an efficient preventive of failing circulation.

URINATION.—Some patients may have difficulty in voiding, especially when first using the urinal. Large amounts of water will render the urine less irritant and more easily voided. A hot wet cloth over the bladder or in the perineum will help. The patient should try using the urinal lying upon either side or upon the back. Catheterization should be avoided if possible. If it be necessary, great care is essential to avoid infection, and the catheter should always be passed by the physician. If cystitis develop hexamethylenamine 0.5 gram ($7\frac{1}{2}$ grains) should be given every four hours. With alkaline urine, sodium benzoate, in the same amount, may be combined with it or acid sodium phosphate 0.3 gram (5 grains) may be administered one to two hours before each dose of hexamethylenamine.

Treatment of the Complications.—**HEMORRHAGE**, occurs in about 7 per cent. of all cases and varies from a few small clots to a large amount. With a small amount of blood in the stool, and no general signs of hemorrhage, no especial treatment is necessary. With liquid blood in the stool and especially with general signs of hemorrhage, a hypodermic of morphine sulphate should be given at once to insure quiet. Food is best stopped entirely for six to eight hours, giving only ice to suck, or small sips of water frequently. At the end of the eight hours, if there have been no further signs, water and albumin water may be allowed. Baths should be stopped, as should other hydrotherapy, and the patient kept flat upon the back. Fæces may be passed into a cotton pad so that the patient need not make the effort of getting on the bed pan. An ice water coil (Leiters), or a light ice bag, should be applied to the abdomen. If there are symptoms of cerebral anæmia from the loss of blood, the foot of the bed may be raised six to eight inches. Drugs of the styptic type are valueless. Opium by mouth or by rectal suppository has been highly recommended, with the idea of quieting all intestinal movement. It will mask the first signs of perforation and absence of peristalsis certainly favors tympanites. When hemorrhage is repeated, or when there has been a very large one with collapse, repeated doses of horse serum 10 cc. (2 drams) may help, but transfusion is better. At this time camphor in oil 0.13 gram (2 grains) may be given every four hours. Saline infusions may be used in the collapse of a severe hemorrhage, but as a rule they appear to cause further bleeding. At times, thromboplastin (for intravenous use) may be injected in doses of 10 to 20 cc. (2 to 5 drams), and seems to help in controlling the hemorrhage. When food and water by mouth are resumed, calcium lactate 0.5 to 1 gram (8 to 15 grains) may be given every 4 hours, to help increase the clotting time of the blood.

PERFORATION.—The diagnosis of intestinal perforation, or of probable perforation, is an indication for surgical intervention, and the sooner the patient is operated upon the better. It is extremely important that the diagnosis be made on the first signs and before a general peritonitis sets in. There should be no delay for "recovery from shock." The operation may be done under a local anæsthetic, and probably, speed is the most important factor in the surgical technic, aside from closing the perforation.

RUPTURE OF THE SPLEEN calls for immediate operation, and usually, removal of that organ.

CHOLECYSTITIS.—Most cases recover with local treatment—an ice bag or hot stupes. All cases should be carefully watched for signs of perforation. It is best to withhold opium as these signs are then masked. If the symptoms are acute and grow steadily worse, laparotomy and drainage of the gall-bladder should be done. It is well to make especial note of cases of cholecystitis and, if the patient have difficulty in becoming bacteria free in the six months after recovery, a cholecystectomy should be considered.

PHLEBITIS.—The leg may be covered with a dry pad of cotton wool and a light bandage, or if painful, a wet dressing of lead and opium wash, or a saturated solution of magnesium sulphate, may be applied. In any case it should be elevated, on a pillow, and kept as quiet as possible. If there is much difficulty with swelling after the patient has gotten up, an elastic stocking, or a woven elastic bandage may be applied.

BED SORES should be constantly guarded against. Keeping the skin over pressure points scrupulously clean and dry, changing the position of the patient every few hours, and gentle rubbing of the skin to improve its circulation at these areas, will do much to prevent bed sores. At the first sign of redness the patient must be kept off the affected area. An inflated rubber ring, or grommets of varying size made of soft cotton batting lightly wrapped with a gauze bandage, should be applied around the pressure area. Early, when there is redness only, 10 per cent. ichthyol in collodion, or a 1 per cent. silver nitrate solution, may be painted on the skin. If the area ulcerate, the sloughs should be cut away gently, and a dressing of dry boric acid powder, or of thymol iodide, should be applied. Later, when healing has begun, ointments may be used.

Boils usually occur late in the disease or in convalescence, and may be very troublesome. Poulticing or hot fomentations are the best local treatment. Yeast is well worth a trial, one-sixth to one-third of a cake of compressed yeast either with or after meals. Vaccine treatment may be effective. If the infection be staphylococcus, a stock vaccine may be tried; if due to some other organism, an autogenous vaccine is best.

OTITIS MEDIA.—The tympanum should be incised at once.

PHLEGMONOUS ANGINA and ulcerative laryngitis may require tracheotomy. If either of these complications ensue, the instruments, for this operation should be on hand, sterilized. The air inspired should be kept moist and the mouth and throat must be cleansed frequently.

PAROTITIS.—At the onset an ice bag may be applied if it relieve the pain. The mass should be incised when brawny or fluctuating.

VOMITING is quite infrequent and usually due to some error in the food. In the high calory diet it is commonly due to too much lactose, occasionally to too high fat. Food and water may be stopped entirely for six to ten hours, or only small amounts of water allowed during this time. Small doses of calomel, 3 to 6 mgm. ($\frac{1}{20}$ to $\frac{1}{10}$ grain), every half hour, in a

powder on the tongue may be effective. Cerium oxalate 0.13 gram (2 grains) every four hours is often used.

PLEURISY.—The affected side of the chest should be strapped if there is much pain. Fluid should be aspirated. If pus be present it should be evacuated and drainage instituted. The operation may be done under local anæsthesia.

BRONCHOPNEUMONIA.—Much may be done to prevent the onset of this condition. The patient should not be allowed to lie in one position constantly. Combating the toxæmia and proper hydrotherapy will help in its prevention. If it develop, the treatment is the same as that for ordinary bronchopneumonia.

POST-FEBRILE INSANITY.—These cases usually recover, but it is best that their care be under the direction of an expert.

TYPHOID SPINE.—In cases due to spondylitis, fixation in a plaster jacket and the administration of typhoid vaccine should be the treatment. An opiate may be necessary to relieve the pain.

BONE LESIONS usually require surgical intervention. A wide excision of the diseased bone is necessary to prevent recurrence. Typhoid vaccines have been highly recommended, and are certainly worth a trial. The beginning dose should be small, twenty-five million, and the amount should be increased according to the reaction obtained, the best results following a mild general reaction.

Causal or Specific Therapy.—**VACCINES** have been used in the treatment of typhoid fever and many reports are enthusiastic. Their use has not, however, been generally adopted, and there is no large series of cases, of several years duration, from which results may be judged. A wide variety of preparations have been in use, and they have been injected subcutaneously, intramuscularly and intravenously, or even given by mouth. There is but one point upon which all observers agree—that the earlier vaccines are used the better are the results. Most men prefer to give vaccine before the tenth day. The interval recommended is from twelve hours to three days, and the number of injections three, four or five. As a rule, the method of injection which permits of the most rapid absorption—intravenous—requires the smallest dosage and the fewer injections. The dose varies from 150 to 250 million typhoid bacilli.

SERUM.—Rodet has developed a serum with which he has treated some 250 cases with a total mortality of 11 per cent. It is used subcutaneously intravenously, or in cases of meningitis, intraspinally, in doses of 10 to 20 cc. The earlier in the disease the serum treatment is instituted the better are the results. Not more than three doses are given, the second and third doses if, and when, the temperature rises.

The Bacillus Carrier.—Osborn reviews the “carrier list” of Massachusetts. It contains fifty-one known carriers, and these persons were apparently responsible for 493 cases of typhoid fever. Of the carriers, 41 per cent. transmitted the infection by milk, and 35 per cent. were in some business in which they handled food. In several cases the long periods of

freedom from infecting proclivities were well illustrated. One man, a milk dealer, caused no cases in 1909 or 1910, nor during the period from 1914 to 1918. In 1919, however, 29 cases of typhoid fever developed on his milk route, and typhoid bacilli were then isolated from his excreta.

It has now been fairly established that the sites of foci of typhoid bacilli are almost always in the gall-bladder or bile-ducts, or in the kidneys, causing respectively the intestinal carrier or the urinary carrier. The former is the usual type. There may be a rare intestinal carrier whose focus of bacilli is not in the bile passages, and it is possible that a sputum carrier may be discovered.

Treatment.—No typhoid carrier should be allowed to handle or prepare food. The only general treatment that may be attempted is the use of vaccines. An autogenous preparation is best. It should be injected in doses of 50 million, increasing gradually to 1500 million, at intervals of eight to ten days, and continued for months. Other treatment varies with the type of carrier.

The Urinary Carrier.—It should first be determined if one or both kidneys discharge typhoid bacilli. If it be found that the infection is in but one kidney, its functional capacity, and its condition as revealed by pyelogram should be determined. A kidney whose function is much reduced, and in which there is an evident pyonephrosis, should be removed. With bilateral infection, or with good function in the infected kidney, hexamethylenamine in doses up to tolerance, 0.5 to 1 gram (8 to 15 grains) four or more times daily, should be continued for months. Irrigations of the kidney pelvis with some antiseptic solution through a ureteral catheter should be tried, and autogenous vaccines should be used. If a single, properly functioning, infected kidney resist this treatment nephrectomy may then be considered.

The gall-bladder carrier is the usual type, the diagnosis being determined by the duodenal tube. Most of the cases have gall-bladder infection alone, but in some, the ducts are infected, either with or without accompanying gall-bladder infection. In a number of cases in which it has been determined that typhoid bacilli are present in the duodenum, cholecystectomy has been done, and in one-half of these cases the infection has disappeared for some months. There is no method by which the extent of infection in the bile passages may be determined except by failure of cholecystectomy to cure the focus. With infection of the ducts, vaccine treatment offers the only hope of recovery.

THE PARATYPHOID FEVERS.

The prophylaxis and treatment of these infections differ in no particular from that of typhoid fever.

A paratyphoid C has been described occurring in the Serbian Army. Men protected by the "TAB" vaccine developed the "C" infection at first, but later infection was prevented by immunity conferred by inoculation with the newly found organism.

II. TYPHUS FEVER.

Prevention.—It has been firmly established that typhus fever is an insect-borne disease, and that the body-louse is the carrying agent. Whenever, during an epidemic, the populace has been effectively deloused, the disease has been controlled.

The person ill of typhus fever, during the febrile stage only, transmits the infecting organism to the louse in ingested blood. A louse, after its infecting meal, apparently incubates the causative organism for four or five days before it is able to transmit the infection, but, from that time, for three or four weeks, its probable life, the louse is infectious. The infection is apparently not transmitted by the bite of the louse, but by inoculation of its excrement, or of its crushed body, into scratch marks or other open skin lesions. The body-louse (*pediculus vestimenti*) certainly, and probably the head-louse (*pediculus capitis*), are the vermin which transmit the disease.

Disinfestation.—**HEAT.**—The body-louse lives in the clothing, and lays its eggs in it, or on the coarser body hairs. The best method of killing lice in the clothing is by heat, either dry, as in an oven, or moist, as by autoclave or boiling. A dry temperature of 55° C. (131° F.) for five minutes will kill insects and eggs, but when a mass of apparel is to be disinfested, heat should be applied for at least twenty minutes, to make sure that all parts of the clothing have reached the proper temperature. Careful ironing of the clothes, with a very hot iron, and paying special attention to the inside seams, will destroy most of the vermin, and, carried out once weekly, will kill a new generation of lice before they have grown sufficiently to procreate.

CHEMICAL.—Several chemicals are effective. The clothing may be soaked in gasoline, or, for one-half hour in a two per cent. trichlorethylene solution in soapy water. The British Army used a powder composed of naphthalene ninety-six parts, creosote two parts, and iodoform two parts, of which 20 grams ($\frac{2}{3}$ ounce), a handful, was shaken into the garments at the neck. The soldier then wore his uniform all night, the heat of his body under the blankets causing evaporation of the naphthalene, and the vapor killing all lice and many of the eggs. Each man also rubbed into the seams of the clothing, 30 grams (1 ounce) of an ointment composed of crude mineral oil, nine parts, soft soap five parts, and water one part.

Alessandri says dry heat and sulphurous anhydrid are the only reliable methods of killing lice and eggs. The latter may be applied by burning sulphur in a closed room, or by the action of sodium theosulphate on sulphuric acid. The clothing to be sterilized is placed in a cask partly filled with four per cent. sulphuric acid solution. When the clothing is saturated, twice the amount of twenty per cent. sodium theosulphate is added, the lid replaced, and the cask shaken. Lice and eggs are killed, while the fabric is unharmed. The body may be anointed from the chin down with ointments, either of one part gasoline and three parts petrolatum, or of five per cent. naphthalene in petrolatum.

Pediculus Capitis lives in the hair of the head and attaches its eggs to the hair shafts. The hair may be washed in a solution of equal parts of kerosene and vinegar, or with gasoline. Both are inflammable and the patient should be kept away from lights or fire until the hair is dry. A mixture of equal parts of xylene, alcohol and ether mopped on the hair has been recommended as highly and rapidly effective. It will not irritate the skin, but it also is highly inflammable. Tincture of *cocculus indicus* (fish berry), and tincture of *delphinium* (larkspur) have been used for years in most hospitals, and the latter appears to be thoroughly effective.

The patient with typhus fever should be sent to an isolation hospital. There, he should be undressed in a special admitting room, the body and hair disinfested, and the patient then put in the regular ward for such cases. The clothing should be piled in a sheet, or thrown directly into a sterilizer or chemical disinfectant. The floor and walls of the room should be scrubbed with hot 3 per cent. compound cresol solution to destroy any infectious louse excrement.

The family, or persons living in the same house with the patient, should have their clothing and bodies disinfested in the same way. They should be closely quarantined for a period of eighteen days from the disinfestation. The room from which the patient came is best fumigated with sulphur.

Physicians and nurses attending cases of typhus fever should take special precautions against infection. They should wear some sort of suit of closely woven material, which will completely cover the body, rubber gloves for the hands, and a tightly fitting cap over the hair. Such measures are especially important for those who handle the patient before his disinfestation.

INCUBATION.—The incubation period of typhus fever is usually about twelve days, but the disease has developed eighteen days after the last possible exposure. Persons exposed are safe from the disease when this time has passed, and contacts with patients ill of typhus should be quarantined for this period.

Immunization.—Prophylactic immunization against the disease has been attempted by means of: 1, a vaccine of the organism, *bacillus typhi exanthematici* isolated by Plotz; and 2, by the use of injections of sterilized blood, freed from fibrin, from typhus patients. Neither method has yet been successful.

Treatment.—The treatment of the disease itself is, at present, entirely expectant and symptomatic. The problem is much the same as that in typhoid fever—the support of the patient through a severe infection. He should be in bed, and is better if constantly in the open air, whenever the weather permits.

DIET.—The food should be liquids and soft solids, and care should be taken that the caloric intake is sufficient. Much the same method of dieting may be carried out as in typhoid fever. Sufficient feeding, and especially, the ingestion of a large daily amount of water, are the best preventive measures against toxic symptoms.

The bowels should move daily. If necessary, a mild cathartic such as phenolphthalein or cascara, should be given every night.

The bladder must be watched for distention, and when necessary, a carefully aseptic catheterization performed.

MOUTH.—Careful attention must be given the mouth, nose, and pharynx. Keeping them clean and as aseptic as possible, will prevent infection of the middle ear, the salivary glands and the throat. The teeth and pharynx should be thoroughly cleansed with a cotton swab, moistened with boric acid or saline solution at least one daily, and the mouth should be rinsed after each feeding with saline solution or a mild antiseptic. The nose should be sprayed at least every four hours with a mild alkaline solution. It may be necessary at any time to mechanically cleanse it.

NERVOUS SYSTEM.—Direct action of the infection upon the brain and meninges appears to be the cause of the severe headache, and of much of the delirium. Both are greatly relieved by lumbar puncture. The fluid should be allowed to drain away until the pressure is relieved, and the drainage should be repeated whenever indicated by a return of the symptoms. An ice bag to the head, and small doses of acetphenetidin or pyramidon will relieve mild headache.

CIRCULATION.—In severe cases, circulatory failure is an early and grave symptom. It should be combated with hypodermic injection of camphor, 0.2 gram (3 grains) in oil, or with *digitalis* by mouth. If there be marked hypotension, epinephrin, in doses of 0.3 to 1 cc. (5 to 15 minims) every two or three hours, is given hypodermatically.

HYDROTHERAPY.—Baths have been found to be too energetic for the weakened myocardium and profound asthenia which most epidemic cases present. Cold sponges and cold packs may be used, and, if followed by improvement of the circulation and lessening of the nervous symptoms, should be continued. In the recent epidemics in Europe, some physicians have forbidden all hydrotherapy.

SKIN.—The skin must, however, be well cared for to prevent superficial infections, bed sores, and the gangrene which is a noteworthy feature of some epidemics. A warm sponge bath twice daily, careful cleansing of the sacral region, buttocks, and genitalia after defecation and urination, gentle rubbing of the skin over the pressure points, and care in seeing that the patient does not lie constantly in one position, are the best preventive measures.

COMPLICATIONS.—The various complications are treated entirely symptomatically.

SPECIAL METHODS.—Glatard has treated 114 cases of typhus fever with intravenous injections of hexamethylenamine. A sterile solution was used and three grams (45 grains) given daily in four doses. It caused an abundant diuresis, and often defervescence after the second injection.

Causal Treatment.—The cause of the disease has not been decided upon, though several organisms have been held to account.

The serum of convalescents has been used, but the great variability of the mortality of different epidemics, and the relatively small number of cases in which such a serum has been injected, renders any estimate of its use of doubtful value.

III. RELAPSING FEVER.

Prevention.—In some parts of the world certain ticks, which live in the huts of the natives, transmit the infecting organism; but in the large epidemics of civilized countries, so frequently associated with epidemics of typhus fever, the body and head louse, and possibly the bed-bug, are the insect hosts of the spirillum. In epidemics of these fevers, the persons most subject to attacks are those who live in crowded and insanitary quarters. The infection is transmitted by the excretions of the louse, or by its crushed body being rubbed into scratch marks, and not by the bite.

Isolation.—The incubation period is usually from 5 to 7 days, but in a few cases it appears to be as short as 12 hours. Persons exposed to infestation with infected lice should be segregated for seven to nine days. Their clothing and bodies should be disinfested at once, and when possible, they should be placed in clean quarters. A previous attack does not immunize.

The patient should be removed to an isolation hospital, and there his clothing and body freed from all forms of lice as is recommended for typhus fever.

The premises in which the patient lived, and the beds and bedding, should be disinfested. Blankets may be steam sterilized. Mattresses, if badly infested, should be burned, or they may be sterilized in a special autoclave. If lightly infested, a thorough spraying with kerosene, or with one of the preparations of gasoline, will probably kill all bed-bugs. The bedstead, especially if it be wooden, must be carefully gone over, with a paint brush wet in kerosene, or a 1 to 200 solution of bichloride of mercury. Heavily infested rooms should be fumigated with sulphur. Two pounds of sulphur are necessary to fumigate each 1000 cubic feet, a room 10 by 10 by 10 feet. The sulphur sticks are ground to a powder, and the powder is then placed in an iron pot heaped about the sides so that a crater is left in the centre. The pot is placed in the centre of a wash tub which has been partly filled with water. Door and window cracks are then sealed with paper strips, the sulphur ignited with alcohol or a hot coal, the exit door closed and sealed, and the room left for at least 6 hours.

In countries where relapsing fever is transmitted by the tick, (Africa) native quarters, or old camp sites, should not be used for sleeping quarters. The tick is said to be able to live for months in the floor cracks and other crevices of such places.

Treatment.—The patient should be in bed and have a sufficient, easily assimilable diet and careful nursing.

SYMPTOMATIC TREATMENT.—The general pains and aches in the bones are controlled by the administration of acetylsalicylic acid or by acetphenetidin. Sleeplessness responds usually to moderate doses of barbital, 0.3

to 0.6 grams (5 to 10 grains), or to sodium bromide in the same sized dose three times daily. Occasionally a dose of codeine sulphate, 0.015 grams ($\frac{1}{4}$ grain), may be necessary. For the collapse which may occur after the crisis, rapidly diffusible stimulants are most useful.

Causal Treatment.—Arsphenamine has revolutionized the treatment of relapsing fever. It should be used as soon as the diagnosis is made, and is best given intravenously in doses of 0.2 to 0.3 gram, (3 to $4\frac{1}{2}$ grains). Neoarsphenamine is as effective, and is far more readily handled and administered. The dose is 0.3 to 0.45 gram ($4\frac{1}{2}$ to 7 grains). The temperature should fall and spirochaetes disappear from the blood in 12 hours after its administration. (Preparation of solutions of arsphenamine and of neoarsphenamine are considered under the chapter on syphilis.)

IV. THE VARIOLOUS DISEASES.

A. Variola Vera—Small-pox.

J. C. WILSON.

THE grouping of the cases for the purposes of descriptive medicine into discrete, confluent, hæmorrhagic, and mild small-pox or varioloid, is not necessary for the consideration of preventive treatment or the management of cases. It is only necessary to insist upon the fact that the mildest case of varioloid may, through failure of recognition or neglect of measures of prophylaxis, become the cause of a wide-spread epidemic in which cases of every type of the disease are liable to occur.

Prophylaxis.—Even at the present time it is impossible in any outbreak of small-pox to isolate all the cases and destroy all infectious material. It is indeed hopeless that the widest diffusion of knowledge concerning the mode of transmission and the dangers surrounding the mildest case would result in practical measures of isolation and sanitation capable of eradicating small-pox. The efficient protection of the individual may be secured by vaccination and revaccination, and the general freedom of many communities has shown that these measures, carried out upon a large scale, prevent small-pox. The preparation, preservation and method of employment of the material used are of great importance, and have been scientifically developed in the biological laboratories of the United States and other countries. The great need is a general understanding of the subject, and willingness on the part of communities to coöperate in the means of protection. Special detached units for small-pox cases should be established in connection with hospitals for contagious diseases in centres of population. As these in ordinary times are only rarely required, there should be an organization of immune nurses and orderlies in the general hospital available for emergencies; and small admission wards or rooms for

suspects, who, in case of error in diagnosis, may not be unnecessarily exposed to infection. In localities unsupplied with proper hospital facilities, the immediate isolation of the early case or cases in a detached vacant house or building, a tent, portable house or even in a private house, and the vaccination without delay of all those exposed to infection are imperative. If cases continue to occur, provision for their care may be made on lines corresponding to the units of military hospitals in actual warfare. These should be located at a point within easy access, but somewhat remote from the built-up sections of the town. Suitable provision for an abundant water supply, the sanitary disposal of sewage and the incineration of dressings and the like should be made.

As a first step in general prophylaxis, immediate notification to the authorities should be made, and upon the proper officials devolves the duty of preparing lists of persons who have been exposed and establishing the means of tracing, for at least a fortnight, any who may have departed.

The period of incubation of vaccinia being shorter than that of small-pox, the preventive power of the former may be utilized by the immediate vaccination of persons who have been exposed, or even at or shortly after the appearance of the initial symptoms. In the latter case, the subsequent course of the attack is thought to be little influenced, but this is uncertain, since the onset is frequently stormy, even in cases that subsequently run a mild course, and there are no means of positively deciding in an individual instance whether such a sequence is due to vaccination or other causes.

The physicians, nurses and other attendants must make use of every recognized precaution against conveying or transmitting the infection beyond the limits of the quarantined area; and the patients are not to be discharged until all crusts have been shed, all mucous discharges and ulcerations healed, the hair cut, and after they have been properly bathed and supplied with fresh clothing.

Treatment.—There is no known specific. The therapeutic indications are many. They vary according to the intensity of the infectious process and may be considered under the headings of general infection, cutaneous, mucous and other inflammatory and ulcerative lesions, hemorrhage, complications, convalescence and sequels.

General Infection.—The room should be well ventilated and cool. All unnecessary furnishings and fixtures should be removed. A portable bath tub should be at hand. Cold water in small quantities should be given at short intervals, and potassium or sodium citrate as diuretics. Chilliness, which after the initial rigor is not common, may be relieved by heat to the feet, and hot lemonade; the high fever by tepid sponging. The most satisfactory results in the excruciating backache and headache follow the hypodermic administration of morphine. The somnolence induced by the occasional repetition of small doses of morphine has also a favorable influence upon the delirium. If necessary, minute doses of hyoscin hydrobromide—0.15 mgm. (gr. $\frac{1}{400}$)—may be added to each dose of morphine.

The delirium requires careful management. It is often violent in the fever that attends the late vesicular and beginning pustular stage. The patients should never be left alone, as they have a strong desire to go home, and may seek to escape by way of the door or window. Their control at this period requires great tact and intelligence. Mechanical restraint aggravates the delirium and should be avoided except as a temporary measure. Alcohol in the form of milk punch and eggnog should be given.

Specific Therapy.—Various attempts have been made to secure a vaccinal serum capable of arresting the pustulation of the vesicles and favorably modifying the course of the disease. The results, up to the present time, are not encouraging.

The diet must be light and should be nutritious. On account of the condition of the mouth, the food should be cool. Milk is the best food, but semi-solids are often more easily swallowed than liquids. Chicken and meat jellies and gelatine foods made with fruit juices, junket, frozen custards and ice cream are among the best. The list may be varied by the occasional substitution of gruels of the better of the proprietary baby foods. It is almost impossible to properly nourish the worst cases, and the more favorable cases are fed without difficulty.

Cutaneous and Mucous Lesions.—Local applications are necessary especially in the confluent cases, to allay the irritation, remove the pus oozing from the broken pustules, control the foul odor which the body exhales, and hasten the separation of the crusts. For this purpose the application of surgical gauze wet with boric acid solution, or hyclorite properly diluted, kept constantly moist and frequently renewed, is very useful. The objection to dusting powders is the tendency to become dry with the pus and form hard crusts, beneath which ulceration and pus formation go on uncontrolled. Applications of the tincture of iodine, in full strength or diluted, or 2 per cent. or stronger solutions of potassium permanganate are recommended to prevent deep pitting with the formation of disfiguring scars on the face. The use of various salves and ointments has not yielded satisfactory results. When the patient picks and tears at the crusts upon his face, it may be necessary to muffle his hands. The hair should be cut close at the beginning of the attack, and in severe cases with an abundant eruption, the scalp should be shaved. Red light, in which the actinic rays are intercepted as a method of treatment to prevent suppuration, advocated by Finsen, has not been generally adopted. This plan, like many others suggested from time to time recently, has not been followed by the hoped-for results. The intolerable sufferings in grave cases may be to some extent relieved by a water bed or a continuous tepid bath. Abscesses should be carefully evacuated. When there is much oozing, the pus may be gently wiped off with moist gauze. Washing with soap and water in the ordinary way is impossible in most of the confluent cases.

The eyes should be carefully cleansed at frequent intervals with tepid boric acid solutions; the edges of the eyelids touched with vaseline to prevent adhesions, and ulceration receive due attention at the hands of the eye

specialist. The pocks upon the mucous surfaces quickly lose their roof from maceration and should be treated by sips of iced water at short intervals, bits of ice allowed to melt in the mouth and rinsing with detergent solutions. In most cases gargling is painful by reason of the action of the muscles involved in the ulceration.

Hæmorrhage.—The occurrence of hæmorrhage into pocks in a limited area, as the result of pressure, contusion or other mild traumatism, does not influence the course of the disease or affect the prognosis. In the true hæmorrhagic forms—*Purpura Variolosa*; *Varola Pustulosa Hæmorrhagica*—we have to do with infections of the gravest character. In the first of these types the prognosis is uniformly lethal. In the second, the prognosis is extremely grave but not without hope. Recovery may occur in the cases in which hæmorrhage into the pocks does not take place until the stage of supuration. These forms of small-pox occur only in unvaccinated or insufficiently vaccinated persons and constitute a pathetic appeal for the universal practice of that measure of prophylaxis against every type of variolous disease. In the group of cases in which some recoveries may be hoped for, the general curative treatment above described should be carried out with energy. I place no value upon ergot, atropin, emetin or turpentine in these cases, nor in gelatine or calcium salts. Nor does there seem reason in the injection of horse serum or the various proprietary preparations made from it. The question concerns an overwhelming infection, the fury of which would have been averted by efficient vaccination at an earlier period.

The Complications.—The complications in the milder cases are few and not important. In the graver cases they are many and serious, as manifested in intense general and wide-spread local secondary infection. To enumerate them would occupy space that may be put to a better purpose, and to indicate the details of their therapeutic management would involve a needless repetition passim of the contents of this volume.

Sequels.—When the skin lesion is superficial, the separation of the crust leaves a red area somewhat elevated and showing hypertrophy of the papillæ. This gradually loses its color and subsides, leaving the skin smooth and slightly pitted. Deeper lesions, attended with ulceration, cause marked and disfiguring pitting; and when the corium is involved, with deep ulceration and abscess formation, much scarring and in some instances warty and keloid thickenings develop. The usual tendency is to a flattening of these lesions and a less abnormal appearance of the face, but in some instances a distressing disfigurement persists. Treatment is unsatisfactory.

Falling of the hair follows severe attacks. If the hair follicles are destroyed, partial or complete baldness follows. Otherwise the growth of new hair takes place. The nails are shed in some cases and it may be necessary to pare away the thickened epidermis over pocks in the palms or soles, or at the margins of the nails. Pigmentation follows the separation of the crusts in the hæmorrhagic cases in which recovery takes place; it is usually dark and extensive and only slowly disappears, especially in the legs.

B. Vaccination.

J. C. WILSON.

The importance of vaccination and revaccination in the protection of the individual and, through the individual, the community, thus preventing small-pox, and the futility of isolation and sanitary methods in the absence of vaccination, have been pointed out in the preceding pages, and more fully under the heading Vaccination in Vol. II. An extended consideration of vaccinia in man as a clinical study, and vaccination as a branch of preventive medicine, do not fall within the scope of the present work. The reader interested in their comprehensive study should consult the admirable articles by Acland and McVail.¹

The Preparation of the Virus.—The establishment in connection with biological laboratories of special detached buildings for keeping the calves and conducting all the processes employed in the preparation of the virus, under the exclusive charge of staffs composed of persons having the necessary scientific and technical training is of great importance. Every operation from the shaving of the animals to the shipping of the virus is conducted under the strictest aseptic precautions, and each package carries the date of its preparation.

Preservation and Transportation.—Under existing conditions great difficulties occasionally arise in obtaining sufficient vaccine material in times of emergency. Even when well cared for, the virus does not retain its full potency more than two months in summer or three months in cooler weather. There is no danger of keeping it too cold. Various methods have been tried. The most satisfactory is the use of glycerine, storage at a little above the freezing point of water, and in the dark. Capillary glass tubes are, by all means, the best containers. For transportation it may be packed cold in thermos bottles.

Technic.—It should be generally recognized that vaccination by puncture or incision is better than by abrasion. The latter affords greatly increased opportunity for accidental infection. The site of preference is the outer aspect of the arm over the insertion of the deltoid muscle. For those who prefer the leg on account of the scar, the outer side of the leg below the fibula may be selected. These positions involve a minimum of danger of injury by accident and of glandular irritation. When necessary a preliminary washing with soap and water may be made. The surface must be bathed with alcohol and then with ether. Surgical cleanliness is essential.

Incision.—The operator, grasping the limb and drawing the skin tense between his thumb and the tips of his fingers makes, with a sterilized scalpel, preferably four and not less than two, parallel incisions one centimeter long and two centimeters apart. Blood should not be drawn; even a

¹ A System of Medicine. Allbutt & Rolleston. Vol. II, Part I, 665 *et seq* and 767 *et seq*. Macmillan Company, London, 1909.

tiny droplet at one or more points should be quenched by pressure with sterile gauze. The virus is then gently spread along the incisions and allowed to dry. A fold of sterile gauze should be applied and lightly held in place by narrow strips of adhesive placed transversely above and below, two centimeters distant from the incisions. This may be dispensed with in the course of twenty-four hours. No so-called "protector" of any kind should be used. These devices are apt to cause congestion, œdema and skin infection and convert a trifling skin lesion into an ugly sore. Should the vesicle be accidentally injured it may be treated like a simple cutaneous wound by zinc ointment, borated cold cream or vaseline.

Puncture.—(Method of H. W. Hill, the official military procedure. Institute of Public Health, London, Canada.)¹.

The arm is washed with soap and water, followed by rectified spirits, then by ether. The virus is expelled at three or four points in the arm in the form of a triangle or square, the points being distant from each other not less than two inches. Six tiny punctures drawing no blood are made through each drop, each set occupying a space of $\frac{1}{8}$ inch square and penetrating very slightly into the epithelial layer. The virus is then wiped off. No after treatment is required. After several days a typical vaccine lesion develops, which in healing leaves a characteristic scar.

Hypodermic Injection.—(Method of I. R. Goodall.)².

The surface is sterilized. The vaccine is blown out of the capillary tube by means of the sterilized rubber bulb into a small sterile beaker. Sufficient sterile water is added to make each injection equal one cubic centimeter. The vaccine is prepared like an ordinary injection, the needle being fine and introduced diagonally into the subcutaneous tissues. The general reaction is like that which follows antityphoid inoculation and as variable in intensity; the local reaction is manifest in heat, tenderness, redness and slight pain.

The advantages of this method are: 1. "It is a clean surgical operation. If untoward results develop they are due to faulty technic. 2. There is no open wound, and therefore dressings are not required. 3. Dangers of secondary infection are practically eliminated. 4. The percentage of positive reactions is very high. 5. In only a small percentage of cases the local and general symptoms caused complete incapacity. 6. It is painless as compared with scarification. 7. Children undergo the hypodermic vaccination without any difficulty owing to the rapidity with which the injection is carried out." The resulting immunity appears to be the same as by other methods, but the absence of the characteristic scars is an obvious disadvantage, since they serve the purpose of a permanent clinical record.

¹ Brit. Med. Jr. Feb. 10, 1917, 189

² Lancet, Aug. 16, 1919, 285.

V. VARICELLA.

J. C. WILSON.

Prophylaxis.—Chicken pox in previously healthy individuals is a very mild infectious disease, and under proper care the prognosis is uniformly favorable. General preventive measures are therefore unnecessary. In persons convalescent from other diseases, cachectic from any cause, or badly nourished, especially children in orphan asylums or similar institutions, secondary infections, gangrene and death occasionally occur. It is for this reason that all such persons should be carefully guarded against the approach or contact of patients suffering from this disease. On account of the superficial resemblance of some mild cases of variola (varioid) to chicken pox, in case of doubt isolation should be practiced. The doubt will disappear in a very brief period. Physicians sometimes permit unmistakable cases of chicken pox to associate with their playmates and companions, with the intention of communicating the disease under favorable circumstances and conferring subsequent immunity. This custom has a very unfavorable effect upon schools, is the cause of much unnecessary anxiety and distress, and is not to be commended. The duration of the attack may last from three to five or six weeks, new vesicles appearing from time to time. The disease is communicable until the last crust has separated. It is important to prevent injury and infection of the lesions upon the face; otherwise permanent scars may result.

Treatment.—Mostly it is expectant. The patient should be kept in bed while the initial fever lasts, and given a light diet with fluids in plenty, water, fruit juices, and fruit.

VI. SCARLET FEVER.

SAMUEL BRADBURY.

While many workers have found the streptococcus in various complicating lesions of scarlet fever, most agree that it is but a secondary invader, and that the actual cause is still unknown.

Scarlet fever is a serious contagious disease, and its spread, in the household at least, can be prevented by proper measures.

Prevention.—The patient should always be rigidly isolated and is best treated in special hospitals. If kept at home, the patient must occupy a separate room to which no one has access but the nurse and the physician. The physician should wear a cap and a gown, and, on leaving, should scrub the hands with soap and water and rinse hands and face in a 1 to 5000 bichloride of mercury solution. The gown should be hung just inside the door of the room, or it may be placed in a small paste board box (hat box) and sprinkled with a few drops of formalin. The nurse should wear a gown and a cap which will cover her hair entirely. She should change her dress, and wash face and hands on leaving the room at the conclusion of her hours on duty.

Night clothing and bedding should be disinfected by soaking in a 2 per cent. cresol solution for two hours. There should be a separate set of dishes for the patient and another for the nurse. After use they should be placed, by the nurse, in a bucket or dish pan full of hot 2 per cent. cresol solution and allowed to stand for one hour before washing.

Scarlet fever is apparently never a water-borne disease so sterilization of excrement would not appear necessary.

Discharges from the throat, ears, or nose, or from any suppurative process, are highly infectious. They should be caught on paper napkins, or on small pieces of gauze, and these, and dressings used for pus discharges, should be burned.

Isolation.—Isolation is from five to six weeks and until all discharge from the mouth, ears, or nose, or the pus from any suppurative process has ceased. The desquamation should be complete. On the termination of a case of scarlet fever the patient should have a thorough soap and water bath, clean clothes, and then be moved to the "clean" part of the house. Books and toys used by the patient should be burned. The room should be carefully fumigated with formalin vapor.

A child is usually considered safe from an attack, if a week without symptoms has elapsed since exposure.

Treatment.—The treatment is expectant and symptomatic only—good nursing, careful feeding, and the proper control of symptoms as they arise.

The patient should be in bed for three weeks from the onset of the disease. The room should be large, and allow of easy ventilation, but be free from draughts. A temperature of 65 to 70° Fahrenheit should be maintained. The bed clothing should be light, and the child should wear a flannel night dress.

Mouth.—Mouth, throat and teeth must be cleansed twice daily with cotton applicators and a mild mouth wash. For cleanliness a daily warm sponge bath should be given.

Bowels.—The bowels should move daily, a mild cathartic, compound liquorice powder or aromatic fluid extract of cascara, being given if necessary.

Diphtheria.—If there be any suspicion of complicating diphtheria, antitoxin should be given at once. It is often well to make a Schick test, and, if this be positive, to give 1000 units of diphtheria antitoxin. Nicoll says—"Probably no other preventive measure has done more to lower the death rate in scarlet fever service in hospitals than that directed toward the prevention of complicating diphtheria."

DIET.—During the fever milk is usually sufficient. Junket, ice cream, and soups made from milk, flavored with vegetables, make pleasant changes. If milk be rejected, the patient may be given gruels, toast, and custard. With the fall in temperature more food is allowed—cereals and toast at first, later vegetables and fruit. No meat broths, beef tea or beef juice should be given at any time. Meat, chicken, and fish are usually withheld

until the end of the third week, and even then it is probably best not to give meat high in nucleins, such as sweetbreads. Eggs may be given after the temperature is normal.

WATER.—The ingestion of an abundance of water should be insisted upon during the fever and during convalescence. It may be flavored with lemon, or orange juice and sugar, be given as barley water, or a carbonated water may be used. If the throat is so affected as to make swallowing very painful, part of the fluid may be given by bowel twice daily.

THE FEVER.—If unaccompanied by delirium or marked restlessness, a temperature of even 104° F. in a child, may be ignored. If the central nervous system is affected by the disease hydrotherapy should be instituted. Warm or tepid sponges are the best methods for controlling such symptoms. A warm bath is also useful. For small children a hot mustard foot bath is effective. The ice cap is grateful to most patients.

THROAT.—With a mild grade of angina, a simple gargle or spray of salt solution every 4 hours is sufficient.

In the severe infections a nasal douche is best and if properly given will not cause sinus infection. The douche bag, filled with warm normal saline, is hung not higher than two feet above the level of the nose. The head of the patient is turned to one side, and the salt solution allowed to flow very slowly in one nostril until a good return flow is obtained from the other nostril. Then the fluid may be allowed to run freely, and nose and throat are thoroughly cleansed. The douching should be repeated every three or four hours.

Antistreptococcus serum, directly applied to the cleansed throat by means of a cotton swab or by atomizer, is often of great assistance in the control of severe angina.

An ice bag may be applied about the neck. Its application should usually not be continuous, but it may be applied for periods of an hour, with an intermission of an hour.

In an occasional case swallowing becomes so painful that the nasal tube (gavage), or rectal feeding becomes necessary.

THE SKIN.—Itching and burning of the skin during the acute stage of the eruption, and later during desquamation, may be very annoying. Cold cream or cocoa butter may be rubbed gently over the entire body. Carbolyzed petrolatum may be used if the itching is intense. It should not be repeated frequently as there is the possibility that enough phenol may be absorbed to produce toxic symptoms. It is doubtful if rubbing with any ointment will hasten desquamation.

CIRCULATION.—In severe and septic cases stimulants may be necessary for rapid and irregular heart action. Digitalis is best for continued use. When immediate action is desired, camphor in oil, or caffeine, may be used.

Causal Treatment.—Earlier attempts at any specific treatment were confined mainly to antistreptococcus serum, but it is now generally agreed that the streptococcus is not the cause of scarlet fever.

SERUM.—Lately the serum of convalescents, taken on the twentieth to twenty-eighth day of the disease has been used. The mixed or “pooled” serum of a number of patients is usually best. Weaver used such a serum in nineteen cases of scarlet fever. There was one death. The dosage was 25 to 90 cc. ($\frac{3}{4}$ to 3 ounces), average 60 cc. (2 ounces), given intravenously. There was a fall of temperature in two to four hours, which continued for twelve to twenty-four hours. In septic cases the temperature rose later but the course was then apparently not as severe. Direct transfusion from a patient convalescent from scarlet fever has been suggested, and would appear as feasible as the use of convalescent serum.

Complications.—**SEPSIS.**—Nicoll says antistreptococcic serum should be used in every frankly septic case. He advises doses of 100 to 200 cc. (3 to 6 ounces), of serum from a horse which has been immunized to numerous strains of streptococcus, including those from cases of scarlet fever. The serum is given intravenously, or, in small children, into the muscles of the abdomen.

KIDNEY.—Acute nephritis is the most dreaded complication, and measures directed at its prevention are the most valuable. Keeping the patient in bed for at least three weeks from the onset of the disease, on an easily assimilable diet, with the ingestion of plenty of water, are the best preventives. The urine should be examined daily so that the earliest urinary signs of nephritic involvement may be noted, and treatment begun at once. If nephritis develop it may be of any degree, and its treatment does not differ from that of any other acute inflammatory process in the kidney. (See page 406).

CERVICAL ADENITIS.—The cervical glands are practically always swollen to some extent. If the swelling be excessive an ice collar is useful. The throat should be kept as clean as possible to prevent undue absorption. If a gland suppurates it should be incised.

EARS.—The ears must be examined as a routine measure, and must always be considered as the possible source of an unexplained rise in temperature. If the drum bulges, the usual incision, in the lower posterior quadrant, should be made. It may be done under cocaine locally, or under nitrous oxide anæsthesia. The ear is then douched as frequently as is necessary to keep the external auditory canal clear, at first about every two hours. The douche bag, with a medicine dropper nozzle, and an elevation of not more than a foot is best.

Infection of the mastoid cells may occur and is usually operated upon at once. Nicoll, however, advises against immediate operation unless there are grave general symptoms of the infection.

HEART.—*Pericarditis and endocarditis.*—The patient must be kept at absolute rest in bed. In acute septic endocarditis, antistreptococcic serum may be used. An ice bag may be applied to the precordium, and seems to quiet an overacting heart, and relieve pain. Its application should not be continuous. If fluid collect in the pericardium to such an extent as to

Disease	Transmitted by	Causative Organism	Incubation.		Quarantine, Isolations or Precautions
			Average Days	Limits Days	
Smallpox.....	contact, fomites	?	9 to 14	8 to 16	2 weeks after all crusts have separated and all discharge ceased. when skin is entirely clean.
Chicken pox.....	contact, fomites	?	10 to 15	21	5 weeks or until desquamation is complete and all discharge ceased.
Scarlet Fever.....	contact, fomites	?	2 to 6	1 to 12	5 days after appearance of the rash, if rash has disappeared and there is no discharge.
Measles.....	contact, fomites	?	9 to 11	8 to 16	until desquamation is complete.
Rubella.....	contact	?	14 to 21	7 to 28	3 successive negative cultures of nose and throat and all discharge has ceased.
Diphtheria.....	contact, carrier	Bac. diphtheriæ	2	2 to 7	until nose and throat are negative for meningococci.
Cerebrospinal Fever.....	contact, carrier	Meningococcus	?	?	precautions that sputum does not infect others.
Pneumonia.....	contact, carrier	Pneumococcus	?	1 to 4	precautions that sputum does not infect others.
Influenza.....	contact	Bac. influenzae	?	8 to 30	1 week after all swelling has disappeared.
Mumps.....	contact	?	18	7 to 21	3 weeks after onset of the whoop.
Whooping Cough.....	contact	Bordet-Gengou bac.	7 to 10	14 to 28	there is no quarantine rule.
Syphilis.....	contact	Spirochæta pallida	21	2 to 10	until local signs and any discharges have disappeared.
Gonorrhœa.....	contact	Gonococcus	5	to 1 year	burn all discharge or dressings.
Erysipelas.....	contact	Strep. erysipelatosus	3 to 7	2 to 6	isolate patients from mosquitoes until fever has terminated.
Tetanus.....	contact	Bac. tetani	1 to 20	1 to 5	screen patient from mosquitoes.
Yellow Fever.....	mosquito	Spirochæta icteroides	3 to 4	widely	isolate until end of fever. Kill all lice and ticks.
Dengue.....	mosquito	Plasmodium Malariae	3 to 5	9 to 17	isolate until end of fever. Kill all lice.
Malaria.....	mosquito	Spirochæta recurrentis	varies	?	kill all bed bugs.
Relapsing Fever.....	lice	Leishmania Donovanii	5 to 7	2 to 9	screen patient from flies.
Typhus Fever.....	bed-bug	Trypanosoma gambiense	12	2 to 10	keep fleas and rats away. Destroy wound discharge and bowel movements.
Kala-azar.....	fly	Bacillus pestis	long	days	burn discharge from wounds and from nose.
Trypanosomiasis.....	rat fleas	Bacillus mallei	3	up to 1 year	burn mouth discharge.
Plague.....	dog bite	Bacillus anthracis	21 to 35	days	burn discharge from wounds and sputum.
Glanders.....	cattle and hides	Actinomyces	few	8 to 23	until 2 successive negative stool cultures have been obtained.
Hydrophobia.....	sheep	Bacillus typhosus	10	8 to 23	until stools and urine contain no bacilli.
Anthrax.....	water and food	Bac. paratyphosus	10	?	until stools contain no amœbæ.
Actinomycosis.....	water and food	Comma bacillus	2 to 5	?	disinfect stools and urine.
Typhoid Fever.....	water and food	Bac. dysentericus	2 to 3	?	
Paratyphoid Fever.....	water and food	Amœba dysenteriae			
Cholera.....	water and food	Mic. melitensis			
Dysentery, bacillary.....	water and food				
Dysentery, amœbic.....	food, goat's milk				
Malta Fever.....					

interfere with the heart action it should be aspirated. (The operation is described in the section on pericarditis).

ARTHRITIS.—The joint should be immobilized by the application of a light splint fastened with adhesive plaster or bandage. In infection of the hip joint extension is better. Methyl salicylate locally may give relief. The salicylates internally are valueless.

Persistent discharge from the nose or throat unduly prolonging the period of isolation is usually due to chronic tonsillitis, adenoid vegetations in the pharynx, or to enlarged turbinates. Adenoids and tonsils may be removed by operation. Nasal abnormalities may be treated with sprays of a mild alkaline solution followed by an albolene spray.

Upon the discharge of a case of scarlet fever the heart and kidneys should be carefully examined for damage, and if any be found, the parents of the child should be told of the trouble.

VII. MEASLES.

Prevention.—Measles is an extremely contagious disease and the susceptibility is practically general. It is nearly always contracted by direct exposure to someone with the disease. The period of infectiousness is from the initial coryza to the disappearance of the rash, or, in those who have developed complications, until all discharge has disappeared.

Isolation.—Isolation and its duration is usually prescribed in orders from local boards of health. In New York City, it is from the onset of coryza to five days after appearance of the rash, provided the rash has disappeared, and the child is otherwise well.

CONTACTS.—Contacts should be segregated for fourteen days, or, as some schools have ruled, from the seventh to the fourteenth day after exposure. During the period of segregation, children should be examined daily, from the eighth day onward, for the first signs of illness. A careful daily estimate of the weights of exposed children may assist in determining which child is developing the disease. If eighteen days have passed, since exposure, without any symptoms, a child will usually not contract the disease. In extensive or severe epidemics it is best to close the schools and other meeting places of children.

The virus of the disease dies quickly after leaving the patient and it is extremely doubtful if the disease is carried by a third person or by fomites.

PATIENT.—The patient is isolated and should have a special attendant. There should be separate dishes, which should be placed in hot cresol solution after use. The physician should wear a cap and gown and should wash his face and hands in weak bichloride solution on leaving the patient. The nurse should wear a gown and a cap which covers the hair entirely, and she should leave the house directly on completion of her daily tour of duty.

It is probably best to soak bedclothing in two per cent. cresol solution.

Discharges from the eyes, nose, and throat, should be caught on paper napkins and burned.

At the conclusion of the case the room need only be thoroughly cleaned and aired for a day or two before its reoccupation.

Treatment.—For the average case of measles the treatment is expectant—only that given any mild infection. The patient is put to bed in a room which can be well ventilated, and is kept there for three or four days after defervescence. A hot bath or a hot drink will assist the maturation of the rash. Colored glasses, or a dark screen between the bed and the source of light, are better than closely darkening the room.

Eyes.—The eyes should be douched with a saturated solution of boric acid. Camphor water in the strength of 10 per cent. may be added to the boric acid solution. The edges of the eyelids may be lightly coated with petrolatum to prevent their adhesion.

Mouth.—The mouth and throat should be thoroughly but gently cleansed twice daily. In young children, a soft cloth covering the finger tip, or cotton swabs moistened in salt solution, may be used. Older children may use a tooth brush, mouth wash, and gargle. The nose may be cleaned with cotton swabs, with a mild alkaline spray, or with the salt solution douche.

Diet.—During the first day or two the patient is often very drowsy and cares little for any food. An occasional glass of milk is sufficient. Later, during the fever, milk, cereals, toast, butter, and eggs may be given. For infants the strength of the milk formula is usually reduced for a few days, and for young children, it is often better to dilute the milk. As the temperature declines, feeding may be more liberal, and, during convalescence, is rapidly increased to the normal diet.

BOWELS.—The bowels should move daily. For children, milk of magnesia or syrup of senna is useful if the child be constipated.

COUGH.—If cough is troublesome, the inhalation of steam from a mixture of compound tincture of benzoin 4 cc. (1 dram), and 1 liter (quart) of boiling water, is useful. Paregoric (*tinct. opii camphorata*), in doses of 0.3 to 0.7 cc. (5 to 10 minims), may be necessary to control the cough at night.

During desquamation the skin should be sponged twice daily, and after sponging, rubbed gently with cocoa butter or cold cream.

Complications.—*Bronchopneumonia* is the most serious, and is treated as when it is the primary infection. The ears should be watched and always accounted for when there is a rise of temperature. If otitis media develop, the tympanum should be incised when bulging.

During convalescence the child should be prevented from using the eyes for long continued reading.

In children who have a persistent cough after measles, careful search should be made for tuberculous foci.

VIII. RUBELLA. (*German Measles*).

Prevention.—The disease is so mild and complications are so infrequent that prophylactic measures are often neglected.

Isolation should be maintained for eight days after the appearance of the rash. Children who have been exposed to a person ill of the disease, may be segregated for twenty-one days, or, if in school, they may be prevented from attending, from the twelfth to the twenty-first day after the exposure.

The patient should occupy a separate room and other children should be kept away from the sick child.

Treatment.—As long as fever persists the patient should be confined to bed. The diet should be easily assimilable. In a few cases there may be severe sore throat, which may be treated with a gargle or spray.

IX. WHOOPING COUGH.

Whooping cough is a disease which is regarded with entirely too much serenity by the laity and by many physicians. It is estimated that the disease kills more children each year in the United States than does scarlet fever.

Prevention.—There are three great difficulties in the way of a better control of pertussis. The catarrhal stage, similar to any sub-acute bronchitis, masks the diagnosis during the period of greatest infectivity. In good weather children with pertussis are certainly better out of doors, and their segregation is then more difficult. Many cases are never seen by a physician unless there is a complication.

Isolation.—The child with whooping cough should be excluded from school, and its association with other children should be prevented. The period of isolation is usually until the whoop has entirely disappeared—rarely sooner than six weeks from the onset of the disease. Contacts should be excluded from school for three weeks.

In institutions, after the development of one case, children with catarrhal symptoms must be regarded as suspicious cases, and should be kept apart from the well children. An early diagnosis in suspects—during the catarrhal stage—is possible by the complement fixation test, and by a differential leucocyte count. The rooms in which institution cases have been cared for should be thoroughly disinfected.

In private families, the child who is well enough to enjoy its usual play offers a peculiarly difficult problem. In cities, especially if the child is a resident of the tenements, days spent in the open parks may determine its recovery. In better quarters, in the city, children may do well if confined to several rooms. Special day camps for whooping cough cases have been suggested, and might be practicable if within walking distance of crowded sections. The transmission of much of the disease could be prevented if those with children in the parks took care that their charges did not play with other children. The usual infecting distance is considered to be about five feet.

Sputum and vomitus should be sterilized whenever possible. With small children this is practically impossible. The child is so terrified that it will disregard all directions for the use of a handkerchief.

In the home, thorough cleaning of the rooms occupied by a child during its illness is usually sufficient to prevent the infection of others who may occupy these quarters after a case is terminated.

Active Immunization.—The consensus of opinion at present is, that inoculation with a vaccine made of the Bordet-Gengou bacillus produces some immunity. The duration of such immunity is questionable, but it is believed to be not longer than a year. It need not, therefore, be considered except during epidemics.

Huenekens claims that the best results are obtained with vaccines not more than a week old and made without preservative. He advises injections of 1500 to 2000 million bacilli, every other day for three doses. The reaction is negligible. Contacts may be inoculated, and there seems to be evidence that some children, at least, are thus prevented from developing the disease.

The production of a serum with any protective or curative power has so far failed.

Treatment.—Treatment is directed at lessening the number and severity of the paroxysms, and the prevention of complications. As in other infections, attention to the details of hygiene and diet are quite as important as are medicinal measures.

General Management.—**HYGIENE.**—An abundance of fresh air is of distinct advantage in lessening the severity and number of the paroxysms. If the child have no fever, and the weather is good and not too cold, it is better out of doors. In the winter, confinement to the house is best, especially in young children. The child should then have the use of several rooms, and all should be well ventilated and, if possible, well lighted. It has been clearly demonstrated that cough is lessened if the air in rooms be free from dust and infected droplets. Therefore a child should be changed twice or more daily to a freshly aired room where dust is at a minimum. The temperature should be between 65 and 70° F. Clothing should be sufficient to keep the body warm. As paroxysms are often followed by a profuse sweat, woollens are best worn next the skin.

DIET.—Vomiting after paroxysms of cough may make the giving of sufficient nourishment a difficult problem. The food should be readily digestible, and care should be taken that the stomach is not overlaid. It is usually best to give smaller amounts of food at more frequent intervals. If a meal be vomited, another should be offered shortly afterward. Cold food may bring on paroxysms of cough. Infants on modified milk are usually fed more frequently with a diluted formula. Young children often do better on a milk diet.

The bowels should move daily, a mild laxative being given if necessary.

Cough.—The cough is the most distressing symptom, and is the cause of many of the complications. Measures directed at its control may be mechanical, local, and general.

MECHANICAL.—A snugly fitting abdominal binder usually relieves considerably the strain of coughing. It should extend from the hips to the lower thorax with shoulder straps to keep it in place. The binder should be made of some elastic material, preferably heavy stockinette. Nägeli has suggested pushing the jaw forward, as is done by anæsthetists, at the onset of a paroxysm.

LOCAL.—Inhalations are of value when there is bronchitis or an abundance of secretion. A mixture of compound tincture of benzoin, 4 cc. (1 dram), to the liter (quart) of boiling water, is poured into a large jar; a paper funnel is fitted over the open end, and the steam inhaled through the small end of the funnel. Oil of eucalyptus, 1 cc. (15 minims) may be used in place of the benzoin.

Sprays for the throat and local applications directly to the pharynx or larynx are best avoided.

MEDICINAL.—No one drug should be continued uninterruptedly throughout the attack; a change always appearing beneficial. Care must also be taken that toxic symptoms are not produced, and that the stomach is not upset.

Antipyrine is the drug of choice. It acts by lessening muscle spasm and dulling the peripheral nerves. In infants the dose is 0.02 gram ($\frac{1}{3}$ grain), and to children of five years of age 0.15 gram (2 grains) may be given. Such doses may be repeated three or four times daily, and, after a day or two, these same doses may be given every three hours. The drug is best administered to small children in syrup of orange, to older children, and to adults, in capsules.

Belladonna, in the form of the tincture, is given in doses of 0.015 to 0.2 cc. ($\frac{1}{4}$ to 3 minims), depending upon the age of the child. A small dose is used at first and this may be gradually increased until there is slight flushing of the face. The drug is eliminated slowly and doses need be repeated only every six hours.

For severe paroxysms, chloroform inhalations are sometimes recommended.

SLEEP.—If the sleep be disturbed, codeine phosphate in doses of 0.6 to 6.0 mgm. ($\frac{1}{100}$ to $\frac{1}{10}$ grain), or paregoric 0.2 to 2 cc. (3 to 30 minims) may be necessary. With marked restlessness bromides and chloral hydrate are useful.

HEART.—With severe and frequent paroxysms the heart may be overtaxed and cardiac decompensation occur. The use of digitalis is then indicated.

Causal Therapy.—The general opinion is that vaccines of either the Bordet-Gengou bacillus alone, or combined with other organisms are of no use during the disease.

The treatment of the complications does not differ from that prescribed when such conditions are primary, and is discussed in the chapters dealing with these diseases.

X. MUMPS.

Prevention.—The prevention of mumps is important, not because there is danger to life, but because of the cost of the disease in time and, in persons beyond the age of puberty, of the likelihood of infection, and consequent functional disability, of the glands of procreation.

In the American Expeditionary Forces, mumps cost more days off duty than any other disease. From July 1, 1917 to March 31, 1919, there were 83,202 cases of mumps which cost the Army 1,000,424 days from duty. But 43 men died from mumps, a death rate of one in every 2000 cases.

In schools, institutions, or other groups of persons living in close contact, epidemics of mumps are peculiarly tedious, extending over months.

The Patient.—The person ill with mumps should be isolated and remain in seclusion for one week after all swelling, parotid or other, has subsided. *Contacts* are best segregated for three weeks. Usually an exposed person is safe from infection, if no disease has appeared in sixteen days after exposure. The cause of the disease is unknown.

Treatment.—The ordinary mild case of mumps requires little or no treatment. During the first day or two, when there is slight fever, a child willingly stays in bed. Adults should be kept in bed for eight to ten days at least, in order that infection of the other glands—testicles, ovaries and breasts—may be prevented. Care should be taken to prevent the slightest trauma to these organs. The testicles should not even be examined unnecessarily.

THE MOUTH.—The normal secretions of the mouth are considerably disturbed, and owing to this factor, and that, when there is much swelling, the usual movements of the mouth and tongue are limited, the mouth will become foul. It should be carefully cleaned twice daily with the tooth brush, or in small children, with a cloth on the finger, and it should be rinsed after each meal.

The sputum or saliva should be caught in paper napkins and burned.

Fever may be excessive, especially in adults on involvement of the testicle, but is of short duration. Cool water sponges may be used every four hours for a temperature over 103° F.

Pain.—In most cases of mumps pain is not severe, and is most marked when the patient must chew or swallow. In many cases no local application is called for, but when swelling is marked there may be a sensation of tension, which is relieved by the application of any simple, clean ointment, and a hot water bag. In a few cases, ice is more grateful.

Food.—The diet should be such that it will require little chewing and may be easily swallowed—milk toast, soft cooked egg, ice cream, junket and custards, and cream soups. Much seasoning, or acid fruits, may cause a momentary pain in the enlarged parotid.

Complications.—**Orchitis.**—The scrotum should be supported, best by a broad strip of adhesive plaster across the thighs. The patient must

remain in bed. An ice bag, or a hot water bag, is usually grateful. Belladonna ointment may relieve the pain.

Meningeal Involvement.—The rare case in which meningeal symptoms develop is relieved by lumbar puncture.

If swelling, of the parotid or testicle persists, the gland may be painted with a mixture of equal parts of guaiacol and glycerine, and the administration of small doses of potassium iodide, 0.3 to 0.6 gram (5 to 10 grains), appears to hasten its reduction.

XI. INFLUENZA.

The recent pandemic has somewhat confused the previously accepted theories with regard to the causative organism of influenza, and, unfortunately, has given us but little help in either a better control of epidemics, or in a more efficient management of the disease. Several organisms, newly discovered or already known, have been brought forward as the cause of the disease, but in no case has the evidence been complete or confirmed, and few attempts have been made to explain why any organism should suddenly assume such frightful virulence. It is practically certain that the disease is the same as that of other pandemics, and that it will appear again, as it has repeatedly in the past.

The most important thing taught by the recent visitation is that, in cities especially, the present organization of society is unable to properly care for those who fall sick.

Prevention.—The extreme infectiousness, the almost universal susceptibility, and the mild ambulatory case of influenza, are the main factors to be reckoned with in preventing a rapid spread of pandemics. The only place where all persons could be controlled would be at the seaports of a country, and most health officers believe this to be impracticable. When pandemic influenza has started in any locality, the ambulatory patient probably does more harm in spreading the disease than does any other factor, and this is, to a great extent, due to the general habit of coughing, sneezing and spitting without regard to the safety of others.

The Patient.—Persons ill with influenza should be isolated, and the presence of the disease should be reported to the health authorities of the community. The patient should be instructed as to the infectiousness of sputum and of the spray in talking and sneezing. Such material should be collected in paper napkins and burned. The period of isolation is usually eight days, provided the temperature is normal and there is no cough or discharge. If five days have elapsed without the appearance of any symptoms, a person who has been exposed will usually not contract the disease.

Personal Prevention.—It is important that the best health be maintained. Food should be nourishing and be digestible. Sleeping quarters should be well ventilated, and if it be possible, they should be well sunned during the day. Alcoholic excess is dangerous. Chilling and wet feet should be avoided. As much as possible crowded places should be avoided, especially those indoors, such as the subway, theater etc. Schools may be closed,

although, with careful daily observation of all children, it is probably better to have them attending school than for them to be penned up in the house, or about the streets where they may meet infection at any time. The mask, for general use, has been decided against. For those in attendance upon persons ill with the disease it is advised. It should be made of four thicknesses of gauze, and measure about four by five inches, so that nose and mouth are covered. Goggles are worn by some to prevent the entrance of infection through the eye. Both mask and goggles should be kept scrupulously clean. Nurses and physicians should carefully wash the hands after examination or care of a patient.

Treatment.—The patient should be put to bed and kept there until the temperature has been normal for at least three days. The room should be well ventilated and light. Bed clothing should be light in weight but sufficient to keep the patient warm.

Bowels.—An initial purge should be given. Afterward the bowels should move daily. A simple laxative is preferable, if any be necessary.

Food.—The food should be easily assimilable and easily digestible, and overnourishment should be maintained. Milk, eggs, cereals, cream soups, toast and butter and any of the milk preparations are best. The caloric intake may be increased by the addition of lactose and cream. Water should be given in amounts of at least two liters (quarts) each day. It may be flavored with fruit juices, and sugar, or it may be taken as a carbonated water.

Fever.—In uncomplicated cases, the temperature is not high nor is it of long duration, and consequently requires little treatment. Cool water sponges are advisable for hyperpyrexia unless they disturb the patient.

Medication.—There is no drug which will cut short an attack. For the pain a salicylate is best. Sodium salicylate may be given in doses of 0.3 to 0.6 grams (5 to 10 grains) every three hours, or acetylsalicylic acid or salicin in the same dosage. Pyramidon, in doses of 0.06 to 0.2 gram (1 to 3 grains) every four to six hours may be useful. An ice bag will often relieve the headache.

Laryngitis.—Inhalations of medicated steam are most useful. The compound tincture of benzoin 4 cc. (1 dram) to the liter (quart) of boiling water, or oil of eucalyptus 1 cc. (15 minims) in a like amount of water are most frequently used. The air of the room should be kept moist.

Cough.—During the early non-productive stage the cough may be constant and irritating, and it should be controlled. *Pulvis Ipecac et Opii* (Dover's powder) in doses of 0.06 gram (1 grain) every three hours will usually control it. Codeine sulphate in doses of 0.015 gram, ($\frac{1}{4}$ grain), may be used in place of Dover's powder.

Circulation.—Failure of the circulation, in the recent epidemic was seen most frequently in the patients who developed pneumonia, and all stimulants seemed to be useless in these cases. Digitalis may be given and is probably the best drug. The heart may be digitalized from the onset but this scarcely would seem necessary in the great majority of cases. Camphor,

0.13 gram (2 grains) in oil, or caffeine and sodium benzoate, 0.2 gram (3 grains) may be used hypodermatically.

Intestinal.—Tympanites and diarrhœa may be due to dietary errors. For the meteorism, hot turpentine stupes, a rectal tube and enemas are the best treatment. Diarrhœa may be checked with bismuth subnitrate 0.6 to 1.3 grams (10 to 20 grains) after each stool. Paregoric (*tinctura opii camphorata*), in doses of 2 to 4 cc. ($\frac{1}{2}$ to 1 dram), may be added if there is abdominal pain.

Complications.—**Pneumonia.**—In the recent epidemic, pneumonia was the usual cause of death. It is treated as is any bronchopneumonia. The œdema of the lungs and cyanosis which were so frequent, are said (Underhill and Ringer) to be due to high blood concentration, as in war gas poisoning. They have suggested a treatment for this condition which appears rational but which was tried in a very few cases. The concentration of the blood was followed from hour to hour by careful hæmoglobin estimations, and, if it were found to be rising, venesection was done with the withdrawal of 250 to 500 cc. (8 to 16 ounces). Then fluids were given in large amounts by mouth, or by vein if necessary. Their results, in the few cases so treated, were quite encouraging.

Meningitis.—But little can be done for the meningitis of influenza but to relieve pressure symptoms as they arise by lumbar puncture and withdrawal of fluid. Practically all cases die.

Pleura.—An effusion should be evacuated by aspiration, and this should be repeated as frequently as the fluid recollects.

Empyema.—If the fluid be frankly pus, even if it is thin and easily aspirated, but little is gained by repeated tapplings. It is best to resect a rib and provide proper free drainage. The operation, in adults, should be done under a local anæsthetic.

Causal Therapy.—Vaccines, either of influenza bacillus alone, or of a mixture of influenza bacilli, pneumococcus and streptococcus, were tried extensively in the recent epidemic. As a curative procedure the vaccine is usually conceded to be worthless. The preventive inoculation was apparently of some value—not in preventing the onset of influenza, but, from numerous studies, it appears that pneumonia was not as frequent, and when it did develop, was not as fatal as in unvaccinated persons. A large total dose of each of the three organisms should be given, in three doses at intervals of four to seven days.

XII. DENGUE.

The causal organism of dengue has not been discovered but it is generally agreed that it is transmitted by the mosquito. Both *Culex fatigans* and *Stegomyia fasciata* are held culpable by various observers, but the question has not yet been satisfactorily settled.

Prevention.—The disease is rarely fatal, but because of the extent of epidemics and the tedious convalescence, it is important that it be prevented whenever possible.

The most important preventive steps are measures directed against the mosquito. Careful screening of the general population, to prevent the bites of infected mosquitoes, should be completed. The destruction of the breeding places of mosquitoes should be undertaken. Water storage tanks must be screened or emptied, small puddles drained, and the larger pools stocked with fish, or a chemical or oil added to kill mosquito larvæ. In Panama better results were obtained by adding a larvicide than by oiling.

The Panama larvicide is made as follows:—"One hundred and fifty gallons of crude carbolic acid having a specific gravity not greater than 0.97 and containing not less than 30 per cent. tar acids, is heated in an iron tank with a steam coil to a temperature of 212° F., and then 200 pounds of powdered or finely broken common resin is poured in. The mixture is kept at a temperature of 212° F. Thirty pounds of caustic soda dissolved in sixty gallons are then added, and the solution is kept at the same temperature until a perfectly dark emulsion without sediment is formed. The mixture is thoroughly stirred from the time the resin is added until the end. One part of this emulsion to 10,000 parts of water is said to kill *Anopheles* larvæ in less than half an hour, while one part to 5,000 parts of water will kill them in from five to ten minutes. This larvicide added to five parts of crude petroleum favors its spread upon the surface of the water. A good method is to place the mixture in a barrel and permit it to drip upon the surface of the stream or pond to be treated." (From U. S. P. H. S. Miscellaneous Publication No. 17).

For those who must be exposed to the bites of mosquitoes, a mixture of one ounce of pine tar in six to eight ounces of castor oil is applied freely to the exposed parts of the body, as advised by Senior Surgeon Carmichael. It will soil the clothing but will not injure the skin.

The Patient.—The person ill with dengue need not be isolated but he must be closely screened to prevent the infection of mosquitoes. It is not known how long a patient may harbor the virus of dengue, but screening is continued throughout the entire illness.

One attack usually confers immunity to future attacks. If individuals exposed to the bites of infected mosquitoes do not develop the disease within six days, they have probably escaped infection.

Treatment.—The patient should be in bed during the whole attack. At the onset, calomel, in small divided doses, 0.015 gram ($\frac{1}{4}$ grain) every half hour for eight doses, should be administered and be followed by a saline purge. The bowels should be kept open daily.

Diet.—Anorexia may be a marked feature and is often accompanied by nausea and vomiting. At the onset only liquids should be given—milk, broths, and fruit juices. Later, as the patient desires, more food may be given, such as toast, butter, cereals, and the simple desserts. When the temperature has returned to normal the patient should rapidly resume the regular diet. Water should be freely taken during the entire attack.

Nausea and vomiting are prominent symptoms in some cases. The initial mercurial purge will often allay the nausea. A small mustard plaster, one to two inches square, to the epigastrium is frequently effective.

Fever.—The temperature may rise to 105° F. or more. The patient should be sponged with tepid or cool water every four hours whenever the temperature is over 103° F. At times a warm bath is useful in reducing fever and relieving the pain if the patient can be moved. An ice cap should be applied.

Pain.—The pain in dengue is said to be excruciating, and relief is demanded. Usually a hypodermic injection of morphine sulphate, 0.015 gram ($\frac{1}{4}$ grain), or of codeine phosphate, 0.03 gram ($\frac{1}{2}$ grain) is necessary. This may be repeated when necessary.

The salicylates, sodium salicylate or acetylsalicylic acid, may be given in doses of 0.3 to 1 gram (5 to 15 grains) every four hours, and seem especially effective when there is severe joint pain.

Insomnia and restlessness are relieved by the administration of barbitol 0.3 gram (5 grains), or trional 0.6 gram (10 grains), or by bromides and chloral hydrate. When sleeplessness is due to pain, an injection of morphine should be given.

Locally, gentle rubbing of the back and limbs, as advised by Coleman, with a mixture of equal parts of oil of gaultheria and spirits of camphor will give relief. Cloths soaked in the mixture may be applied.

Tedious convalescence, with continued pain in the muscles and bones, may be treated with small doses of potassium iodide, 0.3 to 0.6 gram (5 to 10 grains) three times daily. The prostration improves slowly with tonics and good food.

XIII. DIPHTHERIA.

Research medicine has furthered our knowledge of the cure and prevention of diphtheria more than that of any other infectious disease. The knowledge of the micro-organism causing the disease, and its mode of action; the development of an agent, antitoxin, which is at once a specific cure and capable of conferring protection against infection for short periods; a test, the Schick reaction, which informs us of persons who have no natural immunity; and lately, the development of a method of conferring perhaps a permanent protection in the majority of those who are not naturally immune, are all owing to research medicine.

Prevention.—**The Patient.**—The patient should be isolated at once, and is best treated in a special hospital. If at home, the room should be large and airy. Unnecessary furniture, clothing, carpets and hangings should be removed, and as few members of the family as possible allowed to visit the patient. Every article the patient touches should be regarded as contaminated and a possible source of infection to others. Bed and night clothing should be sterilized by boiling, or by soaking for two hours in 2 per cent. cresol solution. A separate set of dishes is necessary and they

should be kept in the sick room. They should be sterilized by heat or chemicals after use and then be washed.

Physician and nurse should wear caps and gowns. The physician should wear a mask covering the nose and mouth, not as a measure of personal protection, but to obviate the possibility of carrying the virulent bacilli to others. The nurse usually finds it impracticable to wear the mask constantly. Both should wash the hands and face carefully before leaving the premises, and should rinse the mouth and throat with an antiseptic solution.

Discharge from nose or mouth should be caught on paper napkins, collected, and burned daily. Fluids used for gargles or douches should be mixed with equal parts of 2 per cent. cresol solution, allowed to stand for two hours and be then discarded.

Rules for the termination of isolation vary slightly, most of them depending upon negative cultures from the nose and throat of the patient. In New York City, two successive negative cultures from the nose and throat, taken twenty-four hours apart, are necessary for release, provided that the first culture is not taken sooner than twelve days from report of the disease. It is important that no patient be discharged before it is proven that he does not carry virulent bacilli.

At the termination of the case, books and toys should be burned. The mattress should be sterilized in an autoclave. If this be impossible, it should be sunned through one or two days. The room should be carefully disinfected with formalin vapor, and before its reoccupation, by children especially, it is best to have the paper removed, and a coat of paint applied.

Contacts.—In institutions, and in families where there are other children, or in any case where desired, persons associated with the patient should have the Schick reaction done. The Schick reaction depends upon the local irritant action of a minute amount of diphtheria toxin injected subcutaneously in those who have no natural antitoxin in the blood. Individuals who are shown to have no immunity to diphtheria by this test, should receive a prophylactic dose of diphtheria antitoxin. For children under two years of age, 500 units are given, older children should receive 750 units and adults 1000 units. This will protect against infection by diphtheria bacilli for one to two weeks.

General Prevention.—It is known that children of two to five years of age are most frequently affected with diphtheria. After the age of five years, for some unknown reason, most individuals gradually develop immunity as they grow older. It is estimated that 70 per cent. of the whole population, and 90 per cent. of adults are immune to diphtheria. It is also estimated that at least half of the cases of diphtheria contract their infection from some source other than a recognized case, and it is believed that the principal source other than actual cases, is the healthy carrier. Such carriers of virulent bacilli make the control of diphtheria a difficult problem. In schools or institutions, such individuals may be spotted on making

cultures of the throats of all persons, and when found they should be isolated at once, and attempts made to rid them of the diphtheria bacillus.

Treatment of the Carrier.—If there be enlarged tonsils or adenoid vegetations these should be removed. Nasal abnormalities which cause a continual irritation should be appropriately treated. Locally, the direct application of antitoxin, by swab or spray has been found to be useless. Powdered kaolin, applied to the nose and throat by means of a powder blower, four to six times daily, has been highly recommended. The kaolin must be perfectly dry, and before each application, the parts must be cleansed with an alkaline spray. Iodized phenol, N. F. (60 per cent. phenol, 20 per cent. each of iodine crystals and glycerine) is also effective at times.

Park says that attempts to clear carriers have sometimes been effective, but more often have failed.

With practical inability to prevent the carrier menace, first because of the difficulty of finding them, and second, because of the difficulty of ridding them of bacilli, the disease may be controlled in a community by the production of an active immunity in susceptible persons.

Active Immunity.—This may be brought about by the injection of the "toxin-anti-toxin mixture." The fluid used in the injections is made of a mixture of diphtheria toxin (amount equal to 400 times the minimum lethal dose for a half grown guinea-pig) and just sufficient antitoxin to neutralize it (about four units), which is so diluted that the dose is 1 cc. (15 minims).

The Procedure.—Children are first tested for natural immunity with the Schick reaction. Those found to be unprotected—those with a "positive Schick"—may then be given the course of injections.

Three doses, each of 1 cc. of the mixture, are injected subcutaneously in the upper arm or back, at intervals of one week. The reaction, both local and general, is very slight in small children, but is more noticeable in older children and adults. No lasting deleterious effects have been observed. The acquired immunity is slow in appearance, the majority of children developing sufficient antitoxin in the blood to give a negative Schick test in the fifth to the eighth week. This of course renders active immunization worthless to protect against recent exposure.

The duration of the immunity is not yet known. Park has followed 100 cases for more than five years and in 90 per cent. of these the immunity persisted. The course of injections may be repeated, if necessary.

Infants who still retain the conferred maternal immunity take the injections without harm, but lose their immunity at the usual time—about six months of age. After the loss of the maternal immunity they may be artificially immunized as are other children.

Treatment.—**Antitoxin.**—Antitoxin, the specific cure of diphtheria, is the most important factor in present day treatment. Discussion as to its value in determining the recovery of patients ill with the disease seems now

quite useless. The following figures from the Chicago Department of Health point a lesson as to the time of its administration:

Cases injected first day of disease, mortality	0.27 per cent.
Cases injected second day of disease, mortality	1.67 per cent.
Cases injected third day of disease, mortality	3.77 per cent.
Cases injected fourth day of disease, mortality	11.39 per cent.
Cases injected later, mortality	25.37 per cent.

One other important factor in success with treatment by antitoxin may be pointed out—that the first dose of antitoxin be sufficient to cure the disease. If the first dose be large enough, later doses do no harm but are useless; if the first dose is too small, diphtheria toxin accumulates in the blood and larger later doses must be given to neutralize it.

Dose.—The following dosage of antitoxin is quoted from Park:

	CASE			
	MILD	EARLY	LATE	SEVERE
	Units	Units	Units	Units
Infant, 10 to 30 pounds, under 2 years	2000 to 3000	3000 to 5000	5000 to 10000	7500 to 10000
Child, 30 to 60 pounds, under 15 years	3000 to 4000	4000 to 10000	10000 to 15000	10000 to 20000
Adults, 90 pounds, and more	3000 to 5000	5000 to 10000	10000 to 20000	20000 to 50000
Method of injection	Intramuscular		Intravenous	

Laryngeal cases are to be considered as severe.

The method of injection is important. Antitoxin is absorbed slowly when injected in the subcutaneous tissues. Its absorption is three times as rapid when given into a muscle, and when injected intravenously, the whole amount is immediately available.

The constitutional symptoms of diphtheria are due almost wholly to the circulation of toxin in the blood. Its early neutralization removes this effect and allows the body to rid itself of the bacilli. In mild cases, and in early moderate cases, the concentration of antitoxin in the blood is sufficiently rapid if the serum be injected into the muscles. In laryngeal cases, in septic cases, and in cases seen after three or four days illness, the toxin must be neutralized at once. Therefore the serum is given intravenously.

Intramuscular Injections.—For intramuscular injection the muscles of the abdomen, or of the back below the scapula, are selected, as in these areas there is so much loose tissue that the presence of a mass of serum causes least pain. The area of skin through which the needle is to be pushed is

sterilized with iodine, and the antitoxin is injected slowly. It is best not to massage the resulting swelling.

Intravenous Injections.—In adults, a vein at the bend of the elbow is chosen, in small children, the external jugular vein is used. In either case the skin at the point of injection is sterilized with iodine. Antitoxin for intravenous use must be clear and free from all sediment; it should be warmed to body heat, and it must be given very slowly, at the rate of 1 cc. (15 minims) per minute. When it is necessary to use antitoxin intravenously, to wait an hour to desensitize a patient sensitive to horse serum may militate against chances of recovery, but it should be carried out.

For any injection of antitoxin, the syringe and needle must be carefully sterilized. The best type syringe is one of all-glass make with slip needles. The whole apparatus may be boiled or sterilized in an autoclave.

Deleterious effects of antitoxin, aside from gross carelessness as regards asepsis, are all due to the globulin fraction of the horse serum which carries the antitoxin, and not to the antitoxin itself. Effects seen are anaphylaxis, foreign protein reaction, and serum sickness.

Anaphylaxis should be especially guarded against if there is a history of asthma, or if horse serum has been administered a month or more previously. The experience in the Great War with repeated injections of tetanus antitoxin at intervals of two weeks or more, shows how rarely sensitization is caused by the administration of horse serum. The prevention of anaphylaxis is not difficult. If its possibility is suspected, a very small dose of antitoxin, 0.025 cc., should be given subcutaneously, and this dose is doubled every half hour until a dose of 1 cc. is given. If no reaction follows this amount, small doses, 0.1 cc., may be commenced intravenously, and the amount doubled every half hour until the requisite number of units have been administered. If anaphylactic symptoms develop the patient should be given an injection of 0.5 to 1.0 cc. (7 to 15 minims) of 1 to 1000 solution of epinephrin, or of atropine sulphate 0.5 mgm. ($\frac{1}{120}$ grain).

The foreign protein reaction appears in one-half to two hours after the injection, its main feature being a severe chill. Hot drinks, hot water bottles and extra coverings are all that is necessary.

Serum sickness is seen usually as a skin eruption, an urticaria being the commonest form. There may be also fever, painful joints, enlargement of the lymph glands and of the spleen. It occurs in from two or three days to two weeks after injection of serum, and, while it may make the patient decidedly uncomfortable, it is not serious. The eruption is usually very irritating, and may be relieved for a few hours at a time by an injection of epinephrin, 0.5 to 1.0 cc. Pain and swelling of the joints are usually relieved by the administration of salicylates.

General Management.—The patient should be in bed, and be kept there until convalescence is well established. The room temperature should be from 65 to 70° F., and good ventilation without drafts should be maintained.

Diet.—The food should be as nourishing as possible. For the first few days it must be such as may be easily swallowed, such as milk, soft cooked eggs, cereal gruels, milk soups, junket and ice cream. With decline of the fever and of the throat symptoms, the diet is rapidly returned to that usually taken. Formulæ for infants are slightly reduced in strength.

In intubated cases, small children are at first fed with a medicine dropper. Older children soon learn to swallow over the tube.

Water should be given freely.

At the onset of the disease a mercurial purge may be given, followed by a saline cathartic. Thereafter the bowels should move daily, a mild cathartic being given if necessary.

Local Treatment.—In mild cases little local treatment is necessary, a simple mouth wash and gargle being sufficient. When the swelling and infiltration of the tissues about the throat are excessive, frequent warm irrigations of the throat and nose are necessary to remove the mucus and exudate. An ice bag, or in young children a hot water bag, to the neck is much appreciated.

Intubation.—The average physician, in the United States at least, is entirely inexperienced in this life saving operation. Many have never seen the operation performed. Its successful execution depends upon careful practise, first upon the cadaver. One must never be in a hurry, and never use force in introducing the tube. Cases of laryngeal diphtheria are far better in special hospitals, where physicians trained in intubation are within immediate call.

The child with laryngeal diphtheria, having had an adequate intravenous dose of diphtheria antitoxin, under such close observation, may be watched for some time to determine whether the symptoms are increasing or subsiding, or whether the child is becoming exhausted. "At the first sign of cyanosis that is permanent and not due to paroxysmal attacks of dyspnoea, relief should be given by intubation." (Park.)

THE OPERATION.—The instrument should be sterilized and the hands of the operator clean. The child, with the arms at the side, is wrapped tightly in a sheet extending from the shoulders to the feet, the loose end of which is securely pinned in several places. The child may then be held in the lap of a nurse or assistant, the head against the left shoulder and held slightly extended by a third assistant; or it may be placed upon a table on its back, with the head slightly extended and held over the end of the table by an assistant. The operator should become accustomed to one position and use that in all cases. A mouth gag is placed in the left side of the mouth and held in place by the hand of the assistant who holds the head. The tip of the index finger of the left hand hooks up the epiglottis and is then pushed to the left as much as possible. The tube on the obturator is passed back along the mid line of the tongue, with the handle of the obturator at first parallel to the body and later raised, as the tip of the tube approaches the glottis. When the tip of the tube enters the larynx, the handle of the obturator is raised so that the tube is parallel to the axis of the body, and it is

then gently pressed down into place with the tip of the left index finger, while the obturator is withdrawn. After several minutes wait to make sure that there is no obstruction to the tube, the string is cut and pulled out while holding the head of the tube.

The tube is allowed to remain in the larynx for four or five days. (Park, Hoyne). Its earlier removal may be indicated if there is difficulty in feeding, but this increases the frequency of reintubations. (Hoyne).

Extubation.—The child is restrained, held or placed upon the table, the head held and the mouth gag inserted as for intubation. The operator locates the head of the tube with the tip of the left index finger. The tip of the extractor follows the inner side of the index finger to the head of the tube, and is inserted into its opening. The jaws are opened, grasping the tube, and the whole is slowly raised until touching the palate. Then the handle of the extubator is depressed to the child's chest and the tube is withdrawn.

Complications and Sequelæ.—**Cervical Adenitis.**—The ice bag usually gives relief, though young children are often more comfortable with hot applications. Should pus form, early incision is imperative.

Otitis media may develop. The drum should be incised, under nitrous oxide anæsthesia, when bulging. Mastoid abscess should be operated upon at once.

Nephritis is rare and usually appears after defervescence. If it occurs the treatment does not differ from that of any acute nephritis.

Heart.—Severe cases of diphtheria and those in which the first antitoxin has been administered late in the disease should be kept flat on their backs in bed for six weeks. Any irregularity in the heart action or a marked increase in rate without adequate exertion means that further rest is necessary. There is no drug that is of use when the heart is affected, with the possible exception of small doses of strychnine.

Paralyses.—Rest in bed, adequate nourishment and, if there is anæmia, the administration of iron, is the best treatment of paralysis. With extensive paralysis of the muscles of the trunk or limbs, massage and electricity should be resorted to, to keep the muscles in as good condition as possible until they may be used. The throat may be so severely affected that swallowing is interfered with. Gavage must then be resorted to.

XIV. VINCENT'S ANGINA.

Extensive epidemics of this disease occurred amongst the soldiers during the Great War, where it was known as "Trench Mouth." In these cases it was located primarily upon the teeth and gums and its incidence appeared to be due to an absence of dental hygiene.

Prevention.—The best prophylaxis is efficient oral hygiene—proper treatment of pyorrhœa, no unfilled carious teeth, as few crowns as possible and those present allowing of surgical cleanliness, and the proper treatment of chronic tonsillitis. A tooth brush and a good dental powder or paste should be used twice daily.

Treatment.—In the mild case recovery occurs under many topical applications, such as tincture of iodine, solutions of silver nitrate of strength varying from 5 to 20 per cent., peroxide of hydrogen, tincture of the perchloride of iron, and solutions of potassium permanganate, applied locally in solution of 1 per cent., or used as a mouth wash in the strength of 1 part to 200 of water.

Drugs.—In obstinate and extensive cases some preparation of arsenic is best. Campbell and Dyas used Fowler's solution (*Liquor Potassii Arsenitis*) swabbed on the ulcers four or five times daily. They also advised the use, in mouth cases, of the tooth wash suggested by Bowman—wine of ipecac 15 cc. ($\frac{1}{2}$ ounce), glycerine 1 cc. (15 minims) and enough Fowler's solution to make an ounce. Four or five drops of this mixture are placed on the tooth brush, and this is used, with vigorous brushing, three times daily.

ARSPHENAMINE.—In 1913 Achard suggested the local use of solutions of arsphenamine in this disease, and, during the recent epidemics of Vincent's Angina, many have found arsphenamine, applied locally, or injected locally or generally, the most efficient treatment.

Local Application.—Arsphenamine 0.1 to 0.3 gram ($1\frac{1}{2}$ to $4\frac{1}{2}$ grains) is suspended in 10 cc. (2 drams) of glycerine, and, after primary swabbing out of the ulcer with a 10 per cent. silver nitrate solution, the suspension of arsphenamine is applied on small pledgets of cotton to the base of the ulcer for fifteen minutes twice daily. The ordinary alkalized solution of arsphenamine has been used as a gargle.

Intravenous Use.—In obstinate and extensive cases arsphenamine or neoarsphenamine have been used intravenously. The dose chosen is a moderate one, 0.3 gram of arsphenamine, or 0.45 grams of neoarsphenamine, and the solutions are prepared in the usual way (see section on Syphilis).

Local Injection.—A number of men in France have suggested the local injections, into the base of the ulcer, of solutions of arsphenamine, in amounts of 0.1 to 1.0 cc. It is said to cause very little local pain or swelling.

Colloidal arsenic was injected into the gluteal muscles, in doses of 6 cc. ($1\frac{1}{2}$ drams), in some 200 soldiers, with marked success.

OTHER LOCAL APPLICATIONS.—Gallaher believes *trichloroacetic acid* to be a specific. He applies it full strength to the ulcers on a fine cotton applicator, and, after the tissues whiten, the whole area is swabbed with sodium bicarbonate solution. A second and third application is made, if necessary, at intervals of two or three days.

Salicylic Acid.—Barth advocates the local application of a 10 per cent. solution of salicylic acid in equal parts of alcohol and glycerine. He also gives his patients a gargle to be used every half hour. It is made of 10 per cent. salicylic acid in alcohol, 15 to 20 drops of which are added to a glass of water.

Dakin's Solution.—One part of Dakin's solution in three parts of water is used for gargling three or four times daily, and is said to be effective.

Tonic Treatment.—In obstinate cases of some duration the patient becomes anæmic and loses weight from insufficient nourishment due to difficult swallowing, and from the absorption of toxic material.

The diet must consist of bland foods of high nourishing value, which require little chewing and are easily swallowed. Milk is the basis of such a diet. Soft eggs, toast soaked in milk, milk soups, ice cream, junket, custard, may be given. Lactose and cream may be added to any of the food to improve its caloric value.

Iron may be indicated in long standing cases. It is best given as freshly made Blaud's Pill (*pil. Ferri Carbonatis*), 0.13 gram (2 grains) three times daily, or as *Ferrum Reductum* in doses of 0.06 gram (1 grain), administered at the same intervals.

XV. CROUPOUS PNEUMONIA.

In civilized communities the natural immunity to pneumonia must be considerable because, even in epidemics, there is a relatively small incidence of the disease. This is supported by the fact that in several large undertakings in which men from less civilized parts of the world were imported as laborers, the pneumonia incidence was so high as to become an industrial problem. It was found, too, that pneumonia attacked the newer arrivals much more frequently than those who had been at work for some months. This would make it appear that persons in close association do develop at least a partial immunity to the pneumococcus.

According to the older ideas on the subject, an attack of pneumonia does not immunize, but even appears to make future attacks more probable. The typing of pneumococci is such recent work that few figures for the type of organism in multiple attacks are yet available. It may be found that an attack of croupous pneumonia of each type of pneumococcus produces its own immunization but leaves the individual open to infection by any other type.

While exact knowledge of the mode of infection by pneumococci is lacking, there are determining factors. Chief of these are the various, often mild, inflammatory diseases of the upper respiratory tract, such as coryza, bronchitis, measles and influenza. Another factor which is of importance is prolonged exposure to cold and wet. Less frequent but easily determinable factors are anæsthesia and trauma.

Prevention.—The prevention of croupous pneumonia is concerned with personal measures, measures directed against the spread of organisms from the patient, and general community measures.

Personal measures include chiefly the care of minor infections of the upper respiratory tract, and avoidance of exposure to cold and wet, whenever possible.

Isolation.—The patient should be isolated, or if in a hospital ward, screens should be so arranged that he will not spray his neighbors whenever he coughs. Sputum and nasal discharge should be caught in paper napkins and burned, or for the sputum, a cup containing a strong disinfecting solution should be used. If sputum get upon the bed or floor it should be

carefully wiped up with a disinfectant solution. The lips and chin of the patient should be washed two or three times daily, especially when the sputum is tenacious, as they are certain to be grossly soiled. In fly time either the ward or the patient should be effectually screened. A good antiseptic mouth wash is of value in lessening the mouth organisms. A separate thermometer and a separate set of dishes should be used for pneumonia patients. Handkerchiefs and bed clothing should be boiled or soaked in 2 per cent. cresol solution.

Physician and nurse should wear caps and gowns, and it is best for them to wear masks covering the nose and mouth. They should also wash the hands carefully on leaving the patient.

At the termination of the case the room, if in a private house, should be carefully cleaned with soap and water, and then thoroughly aired before its reoccupation.

General Prevention.—The one most neglected preventive measure in the community in general is the disregard of habits of decency in coughing, spitting and sneezing in public. There are carriers of virulent pneumococci, and certainly, by such habits, these virulent organisms are freely distributed.

The avoidance of crowding, which in the daily transportation of large cities is often very great, is of probable assistance in the prevention of pneumonia. Any other measure which will increase the average distance between people, such as the "head to foot" rule in barracks for soldiers, the establishment of detached quarters for laborers, etc. should help in lowering the incidence rate for pneumonia.

Active Immunization.—Vaccines to produce immunity to the disease are indicated when large groups of individuals are living together under abnormal conditions. Wright and Lister in the mines of South Africa, and Cecil and Austin, and Cecil and Vaughan, in two of the Army camps in the United States, used vaccines successfully in immunizing men against pneumonia. Cecil advises that the vaccine be made of equal parts of types I, II, and III pneumococci, the "fixed types." This suspension of organisms was given in three doses at intervals of seven days. The first dose was three billion organisms, the second six billion, and the third nine billion. The injection was given subcutaneously and there were few reactions.

The lipovaccine was found to be less effective in the production of immunity, and has been largely discarded.

Treatment.—Croupous pneumonia which, clinically, is the same disease in all cases, has been found by immunological methods to be due to infection by one of three definitely fixed types of pneumococci, or to one member of a fourth group, each of which produces immunizing bodies peculiarly its own. An immune serum of definite therapeutic value has been produced for but type I pneumococcus. In 720 cases of pneumonia treated at the Rockefeller Hospital this type comprised 34.1 per cent. of the infections. In the absence of a universally applicable specific treatment, the care of the majority of patients with pneumonia still depends upon expectant and symptomatic measures. It is to be hoped that a remedy, chemical

or biological, may be developed which may be adapted to all cases. In the meantime, the type of infecting organism should be determined at once for all cases, and if it be type I, the appropriate serum should be used.

GENERAL MANAGEMENT.—The patient should be put to bed at once and remain prone until at least one week after the crisis. There is but one exception to this rule—the rare obese patient, who may be more comfortable propped up in bed or even sitting in a chair. A nurse should be in constant attendance.

The bed should be arranged as is suggested for the care of typhoid fever. Bed pan and urinal must be used throughout the disease.

The room should be large and capable of being thoroughly ventilated. It is preferably sunny, and it should be in a quiet part of the house.

Mental and physical rest are of great importance in the care of pneumonia. For this reason visitors are limited to the fewest possible. The patient should not be allowed to exert himself; the nurse should turn him from side to side whenever necessary. On no account should he be allowed to sit up in bed, for examination of the back, or for any other purpose.

The mouth should be cleansed twice daily and should be rinsed after each feeding. Both nasal chambers should be patent at all times, crusts being removed with forceps if necessary. A warm sponge should be given daily for cleansing purposes.

At the onset of the disease, fractional doses of calomel, followed by a saline purge, should be administered. Thereafter it is important that the bowels move daily, either by enema or by a mild daily laxative, in order that meteorism may be prevented.

FRESH AIR.—The room should be well ventilated and the air be kept as fresh as possible, but the patient must be screened from drafts. Breathing is probably easier in cool air, of about 60° F., but patients differ with respect to this, and their desires should be consulted to some extent. If out of doors in cool weather there should be a hot water bottle at the feet; extra light-weight bed clothing should be supplied and the head should be covered. Shattuck and Lawrence reviewed some 4000 cases of pneumonia from the records of the Massachusetts General Hospital during the years 1822 to 1917. Since 1881 they found the mortality practically constant, 28 per cent., whether the patient was bled, purged, or given fresh air.

The Diet.—**Water.**—During the acute stage of the disease, water to the amount of two to three liters (quarts) should be taken in each twenty-four hours. The value of this measure is well established in all the acute infectious diseases.

• **Food.**—While there is fever, anorexia is usually complete. An effort should be made to provide the patient with sufficient calories though this is not as important as in typhoid fever because of the short duration of the disease. Food should be easily assimilable and of such character that it is easily swallowed and requires little chewing, so that its ingestion may interfere with breathing as little as possible. Liquids are best, milk, milk and raw egg, gruels, cream soups and ice cream. Lactose may be added to

raise the caloric intake but care must be taken that the food does not produce tympanites. After the crisis, nourishing simple food should be given and a normal diet may be rapidly resumed.

Symptomatic Treatment.—Cough, especially during the early part of the disease, serves no useful purpose, and, when painful or disturbing, should be controlled with codeine phosphate 0.015 ($\frac{1}{4}$ grain) by mouth, repeated every six hours or more often if necessary. Later in the disease the cough is usually productive and is not so distressing, but even then, if it disturb the patient overmuch, it should be controlled with an opiate.

Fever.—Hydrotherapy for high temperature only, is probably useless. If the patient is toxic, or has marked nervous symptoms, sponging with cold or tepid water may be done. If the circulation improves and the delirium lessens, sponges should be continued. If the application of cold water to the chest or extremities causes spells of coughing or annoys the patient unduly, sponges should be discontinued. In children and in some old persons with pneumonia the hot mustard foot bath makes them more comfortable. Hot water, with one or two tablespoonfuls of mustard to the quart, is placed in a shallow pan (dish pan) at the lower part of the bed, and the feet, with the patient flat on his back, are immersed in it for twenty minutes or half an hour.

When the crisis occurs the patient must be carefully watched for signs of collapse.

Pain.—Severe pain should be relieved by a hypodermic injection of morphine sulphate, 0.015 gram ($\frac{1}{4}$ grain), and this should be repeated for a return of the pain or for great restlessness. Codeine phosphate, in doses of 0.015 to 0.03 gram ($\frac{1}{4}$ to $\frac{1}{2}$ grain) may be effective in relieving the pain, and is less likely to cause the nausea of which some patients complain after morphine.

For pain of moderate intensity, one of several local measures may be efficacious. One of the best of these is the application of dry cups. Four to six may be applied over the painful area and left on for 10 to 15 minutes. An ice bag is grateful to some patients, while others prefer heat, best applied as a large flaxseed poultice. None of these local remedies has any influence upon the pneumonic process, and, if they fail to relieve pain which causes fretting or restlessness, an opiate should be given.

Venesection.—In a very few robust individuals the withdrawal of 100 to 200 cc. (3 to 6 ounces) of blood at the onset of the disease may be beneficial in relieving symptoms of pain and breathlessness. The operation is now rarely done.

CIRCULATION.—Digitalis is probably the best drug for use as a stimulant to the circulation. It has been the practice in recent years to partially digitalize the heart in all cases of pneumonia so that, should the necessity arise, digitalization may be rapidly completed by further oral administration. The severe failure of ordinary cardiac disease is relieved rapidly, when there is an efficient myocardium upon which to act, by the administration of large doses of digitalis. It has been shown that a single large dose

of digitalis produces pronounced effect on the heart within two hours, and is probably completely absorbed within six hours. In pneumonia it is unusual for an unforeseen cardiac failure to appear except rarely at the time of the crisis. With a partially digitalized heart, the amount of an increased dose of the drug is always a problem, so that it would seem wiser to await the need of such medication.

The patient who has a cardiac lesion which, while compensated, renders his heart less efficient, should receive digitalis from the onset of the disease. It is best in these cases to give one daily dose, of either the powdered leaf in capsule, 0.1 to 0.2 gram ($1\frac{1}{2}$ to 3 grains), or the tincture 1 to 2 cc. (15 to 30 minims). Patients with decompensation from any cause should be digitalized at once. If it should be determined to give digitalis from the onset in the patient with a normal heart, the powdered leaf 0.1 to 0.2 gram ($1\frac{1}{2}$ to 3 grains), or the tincture 1 to 2 cc. (15 to 30 minims) depending upon the weight of the patient, is administered once daily.

The Hospital of the Rockefeller Institute (Cole) uses digitan in all cases. If the patient is seen early in the disease 0.5 gram ($7\frac{1}{2}$ grains) is administered by mouth on the first, second, fifth and sixth days of the disease; if seen late 1.0 gram (15 grains) of digitan is given on the fourth day, and 0.5 gram ($7\frac{1}{2}$ grains) on the sixth and seventh days.

If digitalis be withheld until the need for it arise, one of the rapid methods of digitalization, described in the section on cardiac disease, should be used. Care should be taken that toxic symptoms are not produced and the circulation thereby impaired.

Strophanthin, given intravenously, is somewhat dangerous, and should be used very cautiously, if at all. It may occasionally be wisely used for the collapse of the crisis. If digitalis has been given previously, the initial dose must be very small, not more than 0.2 mgm. ($\frac{1}{300}$ grain). If no digitalis has been administered, the first dose of strophanthin may be 0.3 or 0.5 mgm. ($\frac{1}{200}$ to $\frac{1}{20}$ grain). If the pulse then has slowed, further medication should be by one of the digitalis preparations. If in two hours there has been no change in the pulse, a further intravenous injection of strophanthin, 0.2 mgm. ($\frac{1}{300}$ grain) may be given. For these injections either ouabain (crystalline strophanthin-G) or amorphous strophanthin may be selected. They should be given in a dilute solution and care must be taken that none of the drug is injected into the tissues as it is exceedingly irritating.

CAMPHOR.—In the case with sudden collapse, a hypodermic injection of camphor, 0.1 to 0.2 gram ($1\frac{1}{2}$ to 3 grains) in olive oil may be administered and this dose repeated every two hours until no longer necessary.

Caffeine and sodium benzoate may be given hypodermatically under the same circumstances. Neither of these stimulants should be used in a routine manner.

Strychnine sulphate in large doses is said to raise the blood pressure by stimulation of the vasoconstrictor centre, and, by its action upon the respiratory centre, to increase respiration. Doses large enough to have beneficial

action on these centres often cause much nervous irritability, and in that event are best discontinued. The dose is 1.5 to 3.0 mgm. ($\frac{1}{40}$ to $\frac{1}{20}$ grain), which may be repeated every three hours.

Causal Therapy.—Various salts of quinine have been used for years in the treatment of pneumonia. A derivative of quinine, ethylhydrocuprein (optochin), was advanced some years ago as a specific for the treatment of pneumonia. Results with it have been disappointing; there was no lowering of the mortality, and about one-tenth of the cases developed amblyopia of varying degree. It should not be used.

Antipneumococcus Serum.—Numbers of mixed sera for all types of pneumococci may be purchased, though the only type of organism for which a serum of proven immunological value has been produced is for type I pneumococcus. This was developed by Cole and his co-workers at the Hospital of the Rockefeller Institute. Its efficacy depends upon its early use in pneumonia caused by type I organisms, and in these cases it has materially reduced the mortality.

In the first class laboratory of the progressive hospital, determination of the type of organism is not a matter of difficulty, but the necessity for reliable work of this kind is not yet fully recognized, and the delay caused by waiting for the report of a laboratory at a distance is very trying. Under these circumstances, a number of clinicians have advised that type I serum be given in full doses to all cases as soon as desensitization to horse serum is completed, and that sputum for type determination be collected at the same time. Some clinicians, when it was impossible to obtain accurate type determination, have advised the use of a serum produced by inoculating the horse with the three fixed types of pneumococci, and report good results. The cause of such results is problematical; they may be due only to the injection of foreign protein; certainly the experimental production of a serum of high potency against types II and III pneumococci has failed.

The temptation to use serum in either of these ways, and, if a good response be obtained, to continue its administration, is very strong. It should, however, be realized that there is the possibility of producing a severe chill, and the probability that, in a week or ten days serum sickness will develop, which, while not dangerous to life, the occasional patient describes as worse than the pneumonia. Cole advises against the use of any serum, except the small dose necessary to desensitize, until the type of infecting organism is known.

PROCEDURE OF ADMINISTRATION.—*The Skin Test.*—When the diagnosis of pneumonia has been made, the possibility of serum administration must be considered, and it is necessary to know whether or not the patient is sensitive to horse serum. To determine this the intradermal skin test is employed. With a fine needle and an accurately graduated syringe 0.02 cc. of ordinary sterile horse serum, or of the antipneumococcic serum, diluted to 0.2 cc. with sterile normal salt solution, is injected into the skin of the inner side of the forearm, as is done with infiltration anæsthesia. The injection should make a small bleb under the epidermis. A like amount of sterile

normal salt solution is injected under the skin of the other forearm as a control. If the patient is sensitive to horse serum, in five to ten minutes time a small wheal develops, which will last about an hour and will usually attain the diameter of three to six centimeters. Patients who do not develop the wheal should have an injection of normal horse serum or of the anti-pneumococcic serum, 1 cc., given subcutaneously. This serves to prevent symptoms due to mild sensitiveness to horse serum which would not be shown by the skin test.

The patient who develops the wheal upon the intracutaneous injection of horse serum is sensitive, and the administration of horse serum, even in 1 or 2 cc. doses, is extremely dangerous without careful desensitization. This is done by starting with the subcutaneous injection of very small amounts of antipneumococcic serum, 0.025 cc., and doubling this dose every half hour until a dose of 1 cc. is given. Then 0.1 cc. is given intravenously and if no reaction occur, the intravenous dose is doubled every half hour until a total of 25 cc. of serum has been given, a matter of six to seven hours work. If at any time during the gradually increased dosage, minor signs of anaphylaxis occur—dyspnoea, flushing of the face, increased pulse rate, or cyanosis—the administration of the small doses is stopped for two to four hours, and at the end of this time the dose causing the reaction is repeated, and if there is then no reaction, the gradual increase is resumed. Four hours after the 25 cc. has been given in small doses, 50 cc. is given very slowly intravenously, and then in eight hours time, the usual doses of anti-pneumococcic serum.

DOSAGE.—To be effective the serum must be given in large doses. The initial injection is usually 100 cc., and this dose should be repeated every eight hours until definite improvement occurs. The amount required for each case is 200 to 500 cc. For the first injection, at least, it is wise to have ready for immediate use a syringe with a dose of epinephrin 1 cc. (15 minims), and one with atropine sulphate 0.5 mgm. ($\frac{1}{120}$ grain).

INJECTION.—A vein at the bend of the elbow is selected in adults; in children the external jugular vein is best. The skin is sterilized with tincture of iodine. The serum, warmed to body heat, may be injected with a syringe, but it is better to use a funnel and rubber tube, the injection then being by gravity. The first 15 cc. should be given at the rate of 1 cc. per minute and signs of a reaction carefully watched for. If none occur, the remaining serum is injected more rapidly.

REACTIONS.—The reactions seen may be the same as those encountered with the use of diphtheria antitoxin and all depend upon the horse serum. There may be anaphylaxis, which should be guarded against by the careful desensitization described, or protein shock and serum sickness which may not be prevented. Their treatment has been previously described in the section upon diphtheria.

VACCINES.—For the treatment of pneumonia, vaccines are of no value.

Complications.—**Metorism.**—Distention of the stomach or intestines may prove very troublesome, and is especially dangerous in that it limits

thoracic movement. By careful attention to the diet and the bowels it may be usually prevented, and this is far easier than its cure. If it develops, the treatment does not differ from that used for typhoid fever (page 22). Turpentine stupes, rectal tube, enemas, and the administration of solution of hypophysis 0.5 cc. ($7\frac{1}{2}$ minims) may be tried. The turpentine stupes are most satisfactory, after correction of the diet. When the stomach is distended a small stomach tube, or a nasal tube, is passed, though care must be taken that breathing is interfered with as little as possible.

Serous Pleurisy.—A collection of fluid in the pleural sac, of any considerable amount, should be removed by aspiration whenever it is discovered and the pleural sac should thereafter be kept empty.

Purulent Pleurisy (Empyæma).—The border line between a serous effusion and empyæma is broad. Many cases in which there are abundant pneumococci in the aspirated fluid, recover upon repeated tapplings. During the acute stage of the disease, if the pleura may be kept clear by aspiration of the fluid, it is best to wait the few days until the crisis occurs before resorting to surgery. If, however, the fluid be thick and it is impossible to drain it through the needle, it is best to operate at once. The resection of a rib may be done under local anæsthesia.

Meningitis.—Meningitis due to pneumococci is practically always fatal. In cases due to the type I organism, serum should be used intraspinally and intravenously. The dose of serum to be given into the intermeningeal space should be 5 to 10 cc. less than the amount of fluid withdrawn. In all cases pressure symptoms should be relieved.

Arthritis.—Joint infection by the pneumococcus is usually a purulent process, and the pus should be evacuated. After the operation it is best not to splint the part, unless it appear that deformity will develop, as then a better functional result with motion may be hoped for.

Pericarditis.—The patient must be kept flat on his back in bed. An ice cap may be applied over the heart and seems to exert some control upon its rate. If fluid collect in amounts which embarrass the heart, it should be aspirated, or if thick pus, be surgically drained.

XVI. CEREBROSPINAL FEVER.

Cerebrospinal fever is usually to be found in the crowded more insaniary parts of cities, and it is more frequent in the late months of winter, when, to the overcrowding, are added the absence of fresh air, the lack of sunshine, and the dampness of melting snow.

At times cerebrospinal fever becomes epidemic and then attacks the child and young adult of all classes. Such epidemics are not geographically extensive, and even in limited districts the location of cases is often curiously "spotty." While it is supposed that infection is transmitted from the nose and pharynx (coughing and sneezing) the disease rarely attacks more than one member of an intimate group.

It is believed that, in epidemics, carriers play a large part in infecting others with the disease, and, as the meningococcus dies so rapidly outside

of the human body, in the absence of any other known retreat for the organism, the chronic carrier is probably responsible for the endemic cases.

There seems to be good evidence that, as the carrier rate increases, an epidemic is more likely.

Prevention.—The patient is safer to others when isolated; certainly he should be closely screened, and should have his own thermometer and dishes for feeding. Too much trust cannot be laid upon the fact that the organism dies rapidly outside of the body. Any discharge from the nose, mouth, ears, and eyes, or any suppurating lesion, a joint for instance, should be carefully collected and burned. Isolation is continued until all discharge has ceased and there are no meningococci in the nose or pharynx by culture.

There should be a special nurse, who, if the patient is at home, has no intercourse with members of the family. The physician should wear a gown, goggles and a mask to prevent his becoming a carrier to others.

Contacts.—The incubation period is unknown but is probably short, from one to three days. All contacts with the patient should be cultured for the presence of the organism in the nose and pharynx, and if it be present, they should be isolated and treated. Fresh air and sunshine are the best aids in ridding persons of meningococci. Local treatment may be by swab or spray or by the inhalation of a medicated steam. The latter appears to have found most favor of late. Chloramine-T in the strength of about 1 per cent. in steam vapor has been employed and is said to be effective. Dried and powdered antimeningococcus serum insufflated into the nasal cavities is of assistance. Some carriers are extremely resistant to all forms of treatment, others are intermittent in that meningococci are found only occasionally.

Hexamethylenamine, in doses of 0.5 to 1.0 gram (7 to 15 grains) four times daily has been used as a preventive in those exposed.

General Prevention.—The prevention of overcrowding in poorly ventilated rooms is of most importance in general prevention of the disease. The occupants of such quarters should be at least three feet apart when sleeping. In a barracks the "head to foot" rule may be adopted. The new arrivals at any institution or camp should be carefully cared for and, during the first few weeks, should avoid physical exhaustion and mental depression. It is practically impossible to determine and isolate all carriers. The best that may be done is to make cultures of the nose and throat on the close contacts with persons ill of the disease. Individuals with colds and rhinitis should be especially watched.

Treatment.—**General Management.**—The patient is confined to bed in a quiet room. The irritation of bright lights and of noise must be carefully avoided. Ventilation should be good and free from drafts. The patient must be handled very gently as there is always considerable hyperæsthesia.

Skin.—Emaciation is very rapid and bed sores are easily produced. For this reason the skin must be kept scrupulously clean and prevention of the effects of pressure upon bony points must be begun at once. A warm

bath may be given twice daily, the patient then being carefully dried and the tissues, at pressure points, gently rubbed.

Mouth.—The mouth requires careful cleansing after each feeding. Herpes about the lips are frequently severe, and they must be kept clean and not allowed to become the starting point for a second infection. A bland ointment should be applied. It is, at times, necessary to put mittens on children.

Eyes.—There is frequently a mild conjunctivitis which, if neglected, may lead to serious consequences. The eyes should be douched with warm boric acid solution often enough to keep them free of pus, and the lids may be greased to prevent their adhesion.

Diet.—Food should be easily assimilable. Liquids and soft solids are preferable and, when the stomach is retentive, the caloric intake should be increased with cream and lactose. Water should be given freely, as in all infectious diseases, the rectum being used if a sufficient amount is not taken orally.

Bowels.—Constipation is usually a marked feature and is often obstinate. It is best to give an initial purge, and later, a daily laxative or an enema.

Special Symptoms.—Many of the symptoms of cerebrospinal fever are due to pressure of an excess of cerebrospinal fluid and, before the days of serum therapy, lumbar puncture and withdrawal of fluid was the most efficient relief for headache, delirium, coma, and difficulty with the pulse and respiration.

Headache.—The headache at the onset of the disease is often severe and should be relieved. Clipping of the hair and the application of an ice cap gives some relief, but usually a drug of some sort is necessary and then small doses of an opiate are best.

Mental Symptoms.—Restlessness, delirium and irritability are often best relieved by the withdrawal of cerebrospinal fluid. In preserum days chloral and bromides, and opiates were given in large amounts. They may be employed now as adjuncts to serum therapy. Probably an opiate is best, the dose being carefully gauged to the age of the patient.

Fever.—The temperature range is exceedingly variable and sponging may cause more irritation than its use warrants. Warm sponges or baths may be tried every four hours and sometimes will relieve the mental symptoms.

Specific Therapy.—Serum for the treatment of meningococcus infections has been the most successful of the purely antibacterial sera. Its development and present practically universal use is due to the work of Flexner and Jobling in connection with the epidemic of cerebrospinal fever of 1904.

Antimeningococcus serum, as used in the United States, is prepared by immunizing the horse to numerous strains of meningococci, producing a polyvalent serum. It must therefore be remembered, that when it is administered, either intraspinally or intravenously, whole horse serum is being

used, and anaphylaxis must be guarded against as is done in pneumonia, (page 74). Anaphylactic shock following the administration of any anti-serum is rather unusual, but its appearance is dramatic and its consequences often tragic. Protein shock must be calculated upon.

There is no question as to the efficacy of the serum in markedly lowering the mortality and in lessening the complications in those who recover. As with all such therapeutic agents its early use in full doses is attended with decidedly better results.

During the past few years it has been found that, like the pneumococcus, meningococci are a group of several serological races, each race producing its own immune bodies. The various types and their nomenclature have not yet been standardized in all countries, but it appears that types found in epidemics differ from the organism found in endemic cases, in that the former are more liable to cause the septicæmic and fulminating cases, while the latter cause the disease located in the meninges as it is usually seen. In Europe, serum prepared by the inoculation of many strains, presumably all types of meningococci (a polyvalent serum), has not been effective, especially in the disease which has been epidemic in England for the past two years. Therefore monovalent sera for each type of meningococcus has been prepared and, after determination of type, has been used with better therapeutic results. In the United States polyvalent serum has been satisfactory.

The majority of cases of cerebrospinal fever when suspected, present only signs of meningitic involvement and in these cases the intermeningeal injection of serum, if given early, effects recovery. When the general systemic infections are seen, the serum must be injected both intraspinaly and intravenously.

Intraspinal Administration.—When cerebrospinal fever is suspected lumbar puncture (Vol. II, page 131) is done. If the fluid is under pressure it may be allowed to run until pressure is relieved. In the adult 50 cc. or more may be withdrawn, and if any of the fluid is cloudy or has the slightest opalescence not due to blood, antimeningococcus serum should be injected. The cerebrospinal fluid withdrawn is then examined for organisms, and, if meningococci be found, the use of serum is continued. If the meningitis is found to be due to some other organism, no harm will have been done.

DOSAGE.—The amount of serum to be given intraspinaly is determined by the quantity of fluid withdrawn. In the adult the dose of serum will vary from 20 to 50 cubic centimeters; in the child from 5 to 30 cubic centimeters. The amount injected should be 5 to 10 cubic centimeters less than the amount of fluid withdrawn, but not as a rule to exceed the amounts given above. In cases of great severity the injection of serum is repeated at intervals of twelve hours for three or four doses. In the usual severe case the interval is twenty-four hours, and as a rule three or four doses are necessary. Each time lumbar puncture is done the cerebrospinal fluid is allowed to drain until pressure is relieved, the fluid coming away in slow drops. Each fluid should be examined for meningococci, and when they

are no longer found, serum may be discontinued after one or two further doses. A recurrence of symptoms requires the further injection of serum.

In a small number of cases, usually after one or two serum injections, either sterile fluid or a "dry tap" will be obtained though signs of meningitic involvement are present. The fluid may be too thick to drain through the needle or adhesions may have formed blocking off the lower part of the intermeningeal space. Manipulation of the head under anæsthesia (Cobb), may be effective in breaking down adhesions in the region of the foramen of Magendie, and thus producing a flow of fluid. If this occurs the serum may be given in the usual manner. If not, the injection of serum into the lateral ventricle should be considered. This is done, in the infant, through the anterior fontanelle; in adults and older children a trephine opening is made through the skull. Lewkowicz gives to all cases serum into the lateral ventricle and punctures the skull with a grooved drill of 1.5 millimeter diameter. In infants the needle is inserted to a depth of 40 millimeters, in the child 50 to 60 millimeters, and in the adult 60 to 75 millimeters.

TECHNIC.—Serum to be injected intraspinously or into the lateral ventricle should be clear, warmed to body heat, and given very slowly by gravity pressure only. Never should an attempt be made to force the fluid. Many commercial preparations are put up in containers which act as funnels, with lumbar puncture needle and rubber tubing complete. In the absence of this arrangement, the best apparatus is the barrel of a 20 cubic centimeter glass syringe for a funnel, about two feet of narrow rubber tubing, and a metal connecting tip to fit the lumbar puncture needle. The needle is first inserted as described in Volume II page 131, and, when the fluid begins to flow, the metal connection is slipped into place allowing the cerebrospinal fluid to mount into the syringe barrel. On reaching the 20 cubic centimeter mark the funnel is emptied and fluid is again allowed to run in, repeating the operation until pressure is relieved. During this part of the operation the funnel is held at about the level of the lumbar puncture needle. When fluid ceases to flow, the syringe barrel is emptied, noting the total amount of fluid withdrawn; it is then lowered slightly and just sufficient fluid allowed to run in to fill the rubber tubing and cover the bottom of the syringe barrel. Serum is then poured into the funnel to the 20 cubic centimeter mark and by raising it slightly the serum flows gently into the intermeningeal space. When the proper dose, determined by the amount withdrawn, has been injected, the needle is left in place for several minutes as there are, exceptionally, grave symptoms immediately following the injection of serum. With the needle in place the serum may be at once withdrawn. Such symptoms are convulsions, cyanosis, or difficulty with the pulse or respiration.

SERUM INTRAVENOUSLY.—In a certain proportion of cases, especially during epidemics, there is a definite meningococcus bacteræmia which may be recognized clinically and is easily demonstrated by blood culture. Some observers believe every case begins as a bacteræmia and advise intravenous

serotherapy in all cases. In the great majority of cases recovery is complete with intraspinous therapy, and intravenous injection is not necessary.

In cases with a bacteræmia, in fulminating cases, in cases with a severe rash, and when meningococci persist in the cerebrospinal fluid after six or eight doses of serum intraspiously, antimeningococcus serum should be administered intravenously. The same precautions must be observed as with antipneumococcus serum. The skin test is done; every patient is first desensitized by the subcutaneous injection of 1 cubic centimeter of serum, and one hour later 75 to 100 cubic centimeters of serum are given by vein. The first 15 cubic centimeters are injected at the rate of 1 cubic centimeter per minute. The dose is repeated at intervals of 8 to 24 hours, depending upon the severity of the infection. The same sequelæ, protein shock and serum sickness, due entirely to the horse serum, are met with as after the use of antipneumococcus serum.

Complications.—**Ears.**—Otitis media may occur. A bulging drum should be incised and the external auditory canal douched with warm boric acid solution frequently enough to keep it clean. Mastoid abscess should be operated upon at once.

Deafness and blindness, due to involvement of the auditory or optic nerve, may clear up considerably after months.

Arthritis.—The affected joint should be immobilized by the application of a light splint. Suppuration may occur. The joint should then be aspirated and if a pure culture of meningococci be obtained, all fluid may be removed by aspiration and antimeningococcus serum injected. If improvement does not occur, the joint should then be opened and drained.

Pericarditis will usually subside under rest in bed. If it is necessary to aspirate the pericardium and meningococci are found in the fluid, serum may be reinjected.

Sequelæ.—Emaciation is often extreme after an attack of cerebrospinal fever. With the decline of fever a normal, easily digestible diet may be prescribed. No work should be undertaken for months. In a few cases there are permanent paralyses.

XVII. TREATMENT OF ERYSIPELAS.

Prevention.—Erysipelas is due to the infection of breaks in the continuity of the skin. With present day asepsis the danger of the infection of operative wounds, of puerperal women, and of the umbilical cord of infants is much lessened. It is the neglected abrasion or small cut about the hands or face upon which erysipelas is engrafted. Surgical asepsis, and the proper cleansing of all wounds, no matter how small, will prevent the disease.

The patient, if in a hospital, is best isolated, and certainly should be removed from a surgical or maternity ward. Bed clothing and night dress should be boiled, and everything the patient handles should be considered contaminated, and should be sterilized, either by heat or by chemical disinfection. The room in which the patient has been confined should be

fumigated at the termination of the case. Certain rooms in old hospitals appear to carry the infection for long periods in spite of every known method of disinfection, and even of scraping and painting.

Attendants upon a case of erysipelas should take especial pains not to transmit the disease. They should wear gowns while caring for the patient and should scrub the hands as if for a surgical operation after leaving the patient. No physician, or nurse should be responsible for the care of surgical cases or of puerperal women while caring for a patient with erysipelas.

In two respects erysipelas, in the large majority of cases, is similar to pneumonia—it is a self-limited disease terminating by crisis, and one attack appears to render the subject more liable to future attacks.

The incubation period and the duration of the infectiousness of a patient are unknown.

Treatment.—In the absence of any specific therapy the problem in treatment is to support the patient through the attack. The extremes of age and incidental chronic diseases account for many of the fatalities.

Diet.—The nourishment should be easily assimilable and of high caloric value. Milk, eggs, toast, butter, the various preparations of milk, and milk sugar are best.

Water should be given freely. The average patient should ingest at least two liters (quarts) daily.

Fever.—The patient may be sponged for high temperature, every four hours if he is made comfortable by it. Cold or warm water may be used, whichever is preferable to the patient.

Delirium.—Chloral or bromides will usually quiet restlessness and delirium. They are best administered in small repeated doses over a day or two, 0.3 gram (5 grains) of chloral hydrate, or 0.3 to 0.6 gram (5 to 10 grains) of sodium bromide 3 or 4 times daily, are usually more efficacious than large occasional doses. An opiate may be necessary and morphine sulphate 0.015 gram ($\frac{1}{4}$ grain) should then be used. Pain is rarely severe, but should it be so, an opiate should be given.

Medication.—There is probably no drug which has any effect upon the process, nor is there any procedure which will stop its advance. Tincture of the perchloride of iron has been recommended in doses of 0.5 to 1 cubic centimeter (7 to 15 minims) three times daily, but it is doubtful if it has any special value.

The injection of various antiseptics, at or just beyond the edge of the spreading inflammation, has been practised but is now largely discarded.

Local Applications.—The application of one of the many suggested preparations to the inflamed area is designed to make the patient comfortable and has probably no effect on the disease process.

Cold applications are usually preferred. A saturated solution of boric acid in water, 30 to 50 per cent. alcohol in water, or a saturated solution of magnesium sulphate in water may be used. The latter has the advantage of being relatively inexpensive and easily prepared. When there is inflammation of the face involving the eyelids, cold boric acid compresses are best.

Some patients may prefer an ointment and then 10 per cent. ichthyol in benzoinated lard (*adepts benzoïnatus*) is to be preferred.

Causal Therapy.—Autogenous vaccines and various antistreptococcic sera have been advised but most observers have found them worthless.

Complications.—Collections of pus beneath the affected area, especially when the scalp is involved, must be watched for, and, when found, must be opened and drained.

When there is marked swelling of the eyelids, douching of the eyes will be necessary. Lambert says it is sometimes necessary to incise the eyelids to reduce an œdema of such extent that it may result in gangrene.

The unusual complications, such as acute endocarditis, pleurisy, and meningitis, are treated as when they are primary infections.

XVIII. SEPSIS.

For purposes of treatment the exact classification of the general blood infections, collectively grouped as sepsis, is relatively unimportant. A general grouping may be made—acute sepsis (*septicæmia*, *septicopyæmia*, *pyæmia*), which usually kills within a few weeks, sometimes in 3 or 4 days; chronic sepsis (focal infection), which produces degrees of disability varying from a level of general subnormal health to the wrecking of some vital organ, such as the joints, heart or kidneys, and completely confines the patient to bed. In chronic sepsis the patient dies of an intercurrent acute infection, or from decompensation of a damaged circulatory or excretory system. What must be known for the intelligent treatment of sepsis are, first, the portal of entry of the bacteria into the body, and second, the variety of organism causing the disease. It should be recognized too that in sepsis of any degree there may be formed secondary foci of pus which must receive the same attention as that given to the primary focus.

Probably in every case of sepsis there is a primary collection of pus from which bacteria are disseminated into the blood stream. Such a sowing of organisms may be in enormous numbers, and of bacteria of overwhelming virulence; or it may be chronic, even intermittent, with organisms of low virulence and extending over periods of months or years.

Prevention.—The prevention of sepsis pertains to aseptic surgery, the proper care of the teeth and of chronic throat infections, and the assurance that one of the acute infectious diseases, such as pneumonia, scarlet fever, gonorrhœa, or a “cold” has not left the patient with a quiescent collection of pus.

Treatment.—The treatment of each patient with sepsis must be individualized but it is directed upon three general lines.

1.—The elimination of the primary and any secondary foci of infection.

2.—The mobilization of the general resistive powers of the patient and their support by careful attention to the details of hygiene, nursing, and diet.

3.—The utilization of any effective specific antitoxic or antibacterial therapeutic agent or the production of an active specific immunity.

1. **The Primary Focus.**—In most acute explosive attacks of sepsis, such as a hæmolytic streptococcic septicæmia, the portal of entry, or primary focus, is only too well known, but in many chronic or subacute cases the primary focus must be searched for long and patiently.

In the majority of cases of sepsis, including those of all degrees, the portal of entry for pathogenic organisms is to be found in some one of the structures of the head. Teeth, tonsils, nasal cavities and sinuses, pharynx, and ears must be carefully examined by direct inspection and often by the röntgenogram.

Other organs to be searched are the lungs, gall-bladder, kidney and appendix. In the male, prostate and seminal vesicles, and, in the female, uterus, tubes, and ovaries may be the portals of entry. There may be a chronic or acute abscess of the bone-marrow, which, while usually a secondary focus of pus, assumes the primary rôle in an acute sepsis.

A collection of pus anywhere in the body should be removed or freely drained. If the portal of entry be a focus which cannot be removed, such as an infected wound or ulcerative tonsillitis, it is important that free drainage be maintained, and that products of suppuration be washed away as rapidly as they form to prevent their absorption.

2. **Improving the Resistance of the Patient.**—The severe acute case is necessarily in bed. Many of the subacute and chronic cases are better when considerable rest is insisted upon. Fresh air and sunlight are important adjuncts in the care of all cases. Certainly the puerperal woman with sepsis has a better chance of recovery when in the sun parlor all day.

Efficient, careful nursing, with its care of the mouth and skin is also important. With high temperature and marked nervous symptoms hydrotherapy is indicated. (Sponging with cool water is best, and, may be continued every four hours if the condition of the patient is improved. Continued pain and lack of sleep lower the general condition of the patient. Both should be controlled, pain by an opiate, sleeplessness by chloral, bromides, or other hypnotic.

Diet.—The nutrition of the patient, especially in the long continued case, must be maintained by sufficient food. In the absence of disease of the gastro-intestinal tract and of the kidneys, any easily digestible and rapidly assimilable food of good caloric value is allowable. It should be given at frequent intervals, every four hours, and care must be taken that the digestion is not disarranged. Water or other form of fluid should be taken in increased amounts.

There are several non-specific procedures which probably act, when they are effective, by assistance to the general resistance of the patient.

TRANSFUSION.—A number of patients with an apparently hopeless acute sepsis have recovered after the transfusion of whole blood. It has been suggested that the donor be immunized to the specific organism, or even that donors be immunized to many strains of streptococci, but time rarely allows of the first procedure, and practise has shown that whole blood from any

healthy donor may accomplish the desired result. Methods and technic of transfusion are discussed in the section on Diseases of the Blood.

PROTEIN SHOCK.—The foreign protein reaction is believed to act by causing a sudden mobilization of all the resistive powers of the individual. The value of the treatment is not yet thoroughly established. If used, it would seem best to administer one of the bacterial preparations rather than serum because of the possibility of sensitizing the patient. The various preparations used to produce this reaction and the technic are discussed fully on page 234.

FIXATION ABSCESS.—Fixation abscess is the principle of the old fashioned seton and is believed to act by increasing antibody formation by the irritation produced by the injection of a sterile irritant substance. Oil of turpentine is used, usually injected into the muscles of the buttock or back. When the abscess has formed and been walled off, it is opened and drained. This procedure is rarely used and then only in the blood infections by organisms of low virulence.

Specific Therapy.—The use of any specific therapy must necessarily be discussed in relation to the organism responsible. In order of frequency the causative organisms are the streptococcus, pneumococcus, staphylococcus, meningococcus, colon bacillus, *bacillus aerogenes capsulatus* and the anthrax bacillus. General infection by several other organisms has been described but is extremely rare, and there is no specific treatment.

Of these varieties of sepsis, that produced by the streptococcus is by far the most commonly seen.

Serum.—Effectively active sera have been developed for meningococcus and for pneumococcus type I infections. An antiserum for the treatment of anthrax has also been used with gratifying results, though its principal use is early and before the disease has become demonstrably septicæmic. There are polyvalent sera for streptococcus infections, but they are of uncertain value because of the multiplicity of strains of streptococcus with extreme variations in virulence and immunological reaction.

The use of antimeningococcus serum, the most effective antibacterial serum (as distinguished from antitoxic) we have, and pneumococcus serum type I, have been described in the chapters on the treatment of cerebrospinal fever and of pneumonia respectively.

ANTISTREPTOCOCCUS SERUM.—For infected wounds and ulcerative tonsillitis the local application of antistreptococcus serum may be tried. It should be applied on dressings or swabs and may be of value, though its use is disappointing.

Streptococcus meningitis is practically always fatal. The injection into the intermeningeal space of a polyvalent antistreptococcus serum after removal of as much cerebrospinal fluid as will flow out easily, will do no harm and may be beneficial. The dose is gauged by the amount of fluid withdrawn, it averaging about 10 cubic centimeters less than that removed. With improvement its administration should be repeated at intervals of eight to twelve hours.

Streptococcus empyæma gives a far better chance of recovery than does meningitis, with either frequent aspiration when the fluid is thin, or resection of a rib and free drainage when there is thick pus present. It is doubtful if the usual polyvalent serum would be of advantage, but in severe cases its injection into the pleural cavity may be tried.

Streptococcic septicæmia is an exceedingly serious disease. Most cases die. Antistreptococcus serum should be used and may do good. I have seen two patients in whom recovery appeared to be due to its use in large amounts. It should be given intravenously in doses of 100 cubic centimeters after determination of sensitiveness to horse serum, and desensitizing doses in all cases before the first intravenous injection. With improvement in the symptoms the same dose may be repeated every twelve to twenty-four hours depending on the apparent severity of the infection.

BACILLUS AEROGENES CAPSULATUS.—The gas gangrene infections of the Great War stimulated the study of this group of organisms and several antisera were developed. Reports of the use of such sera are quite variable. The English had little success, the French, on the contrary, appear to be enthusiastic. French Army surgeons injected the serum into the muscles about the wound.

Vaccines.—In acute sepsis the patient is suffering from the effects of the toxins of the infecting micro-organisms. To add further toxins by the injection of killed organisms of the same variety appears to be illogical and this is borne out clinically; vaccines are of no use and may do harm in acute sepsis. In cases of reported benefit it has not been shown that protein shock may not have been responsible for the improvement.

In the more chronic forms of sepsis, however, vaccines sometimes appear to be of value. For any possibility of success the vaccine used must produce antibodies which are specific for the infecting micro-organism. The use of vaccines in the prevention of typhoid fever is so successful largely because the injection of any one strain of *bacillus typhosus* will produce an immunity specific for all races of typhoid bacilli. In sepsis, on the contrary, each variety of causative organism is of a different immunological race, and no one race will immunize for the others. For this reason, vaccines used in sepsis, with the occasional exception of *staphylococcus aureus* infections, must be made of the strain which has been isolated from the blood of the patient—an autogenous vaccine.

STREPTOCOCCUS.—Autogenous vaccines have been used and may be tried but their use is usually disappointing. The initial dose is 25 to 50 million and it may be gradually raised to one billion or more.

PNEUMOCOCCUS.—No therapeutic value has been claimed for the injection of vaccines made of any type of pneumococcus.

STAPHYLOCOCCUS.—Vaccines as therapeutic agents, are of more value in the treatment of infections by staphylococcus than in any other infection. The vaccine is best autogenous though stock vaccines have been used successfully. The initial dose is about twenty-five million and succeeding doses are gradually increased to one billion or more.

COLON BACILLUS.—Vaccines have been used but their use has rarely been attended with any beneficial effect.

GNOCOCCLUS.—Geraghty says that vaccines made of gonococci are of no value in the treatment of gonorrhœa either acute or chronic, or in any of its complications.

Dosage of Vaccines.—The amount given in subsequent inoculations and the interval between doses is governed by the reaction of the patient to the previous dose. The injection of a vaccine for therapeutic purposes should be of such size that it will produce a mild local reaction and no general reaction. In each case the interval before the succeeding dose should be about seven days or earlier if all signs of the preceding dose have subsided. In working up to the dose necessary to produce this reaction, small doses should be given at the start. This beginning dose is then doubled, and injections may be made even daily, until the desired reaction is produced.

XIX. RHEUMATIC FEVER.

Prevention.—To speak of the prevention of rheumatic fever in general terms is impractical. The fact that the disease is non-contagious, that there are no constant factors in determining its attack, and that the etiological agent is still a matter of controversy make the physician quite helpless in preventing the primary onset of the disease.

Later attacks may however to some extent be prevented, especially as an individual, having suffered one attack appears to be more liable to a recurrence.

In a few individuals attacks appear to be induced by exposure to cold and wet. Such patients should wear flannel underclothing, and should select some occupation in which they will not be exposed to the elements. A somewhat larger percentage of patients may give a history of onset of the disease either with, or following by several weeks, an acute tonsillitis. Upon examination there is found chronic infection of the tonsils. In cases of this character the tonsils should be removed in an interval between attacks, especially if the patient is a child. Other definite foci of pus should be eliminated.

Treatment.—Rheumatic fever is an acute infectious disease in which a considerable number of patients develop an endocarditis. The severity of the attack does not parallel the incidence of endocarditis—mild rheumatic fever seems as able to cause this complication as a severe attack, and we have no method by which endocarditis may be prevented.

General Management.—Rest in bed is essential from the onset of the disease and it should be continued until all signs of inflammation have disappeared. The bed spring should be firm and the mattress smooth and elastic. The sheets should be made of wool or the patient may sleep between light blankets in order that the drenching sweats may be better absorbed. For the same reason the night dress should be made of Canton flannel or of wool, and it should be so cut that it may be easily removed.

The usual style hospital gown, made of Canton flannel, slit down the back, is as satisfactory as any. It may be slipped on the arms easily, one tape at the back of the neck tied and tucked in gently at the sides.

Skin.—The frequent acid sweats and sudamina, unless carefully cared for, will macerate the skin and on pressure points may easily lead to bed sores. Owing to the difficulty of moving the patient from side to side on account of the painful joints, the back must be especially well cared for. A bed bath should be given twice daily whenever possible, but they must be gauged to the condition of the patient and the amount of joint involvement. A liberal use of dusting powders, stearate of zinc or a good talcum powder, is of assistance in keeping the skin dry.

Diet.—Loss of weight and anæmia are outstanding sequels of most attacks of rheumatic fever. A diet of easily digestible high calory foods will assist in their prevention. Milk, cereals, toast and butter, eggs, ice cream, and fruit juices may be freely given. Cream and lactose may be added to increase the calory intake. With the decline in fever, simple desserts, mashed or baked potato, and puree of vegetable may be added. Meat is usually withheld until recovery is almost complete, as are broths and meat soups.

FEVER.—Treatment of the fever is usually unnecessary. In rare cases there may be hyperpyrexia and under these circumstances the cold bath or cold pack is indicated.

Pain.—At the onset of the disease pain is often severe. It will be relieved by the salicylates ultimately but at the onset in some cases an opiate is advisable. A small dose of morphine may be given but care must be taken that a habit is not formed. The nurse, by a skilful adjustment of pillows may do much to relieve the pain of inflamed joints.

Local Applications.—Local applications are used for the relief of pain and their effect is due probably only to the counterirritation and partial immobilization of the joint. Many patients are most comfortable with the application of a thick layer of cotton wool extending for some distance above and below the joint, secured with short lengths of bandage tied at intervals. Methyl salicylate (oil of gaultheria) may be gently rubbed on the skin about inflamed joints and the area then covered with a layer of cotton wool as above. Chloroform liniment is also useful and may be used in those individuals who object to the wintergreen smell. All the large joints are more comfortable when they are in partial flexion, and they should be propped in such positions with pillows or soft pads. It is especially important to relieve the strain on joints which have little support when the patient is prone, such as the ankle and shoulders.

DRUGS.—One of the salicylates is the drug of choice and of these sodium salicylate is the best. It is an antipyretic and analgesic and may be called a specific for rheumatism. All the salicylates are irritant to the mucous membranes, sodium salicylate less so than most, and this drug is best taken with an equal amount of bicarbonate of soda, which prevents its precipitation as salicylic acid in the stomach. Full therapeutic doses cause ringing

in the ears and nausea and vomiting, or *salicylism*. In large doses it will cause irritation of the kidney with the production of albumin and casts. Hanzlik has shown the mean toxic dose of sodium salicylate for men to be 12 to 13 grams (180 to 200 grains).

The usual dose is one gram (15 grains) best given in solution combined with an equal amount of sodium bicarbonate, using peppermint water or rhubarb and soda mixture as a vehicle. The dose should be repeated every hour until salicylism develops, usually after 8 to 10 doses. The drug should then be discontinued for 6 to 10 hours and after this period given in amounts of 1 gram (15 grains) three times daily until all signs of the attack have disappeared.

Acetylsalicylic acid is sometimes less irritating to the stomach. The dosage does not differ from that of sodium salicylate and its only advantage is that it may be taken for longer periods by some patients with fewer disagreeable effects. It should not be combined with an alkali. In rare cases the administration of acetylsalicylic acid is followed by an urticarial-like attack, localized to the cheeks, lips and sometimes the tongue and throat, and which may be alarming.

Methyl salicylate (oil of gaultheria) 1 cubic centimeter (15 minims) given in a gelatine capsule or added to milk has been advocated.

The rectal administration of sodium salicylate has been highly recommended and would appear advisable in patients to whom the taste of the drug is objectionable. Heyn says the administration is very easy; that absorption is complete in about 12 hours; that there is a minimum of untoward effects; that large doses may be administered and, as they are slowly absorbed, the excess may be easily removed if salicylism develops; and the effect is promptly manifest.

He gives first a cleansing enema. The drug, dissolved in 120 to 180 cubic centimeters (4 to 6 ounces) of plain or starch water to which one cubic centimeter (15 minims) of tincture of opium is added, is then injected by means of a Davidson syringe, the rectal tube being inserted 6 to 8 inches. For women the first dose is 6 to 8 grams ($1\frac{1}{2}$ to 2 drams), for men 8 to 11 grams (2 to 3 drams), and these doses are repeated in twelve hours. If then salicylism does not develop, the injection is repeated every twenty-four hours, increasing the dose each day by 30 to 50 per cent. until toxic symptoms are manifest. The symptoms of salicylism were those usual for mouth administration, and it is interesting to note that in a few of his series of 122 cases there was vomiting.

Sodium salicylate has also been used intravenously as suggested by Mendel. Conner thinks the intravenous route indicated when there is exceptionally severe pain or when the stomach is unretentive. He used a 20 per cent. solution and 15 to 20 grams (4 to 5 drams) of the drug was given every 8 to 12 hours.

Cinchophen.—Patients extremely sensitive to the salicylates may be given cinchophen or neocinchophen. Hanzlik has shown that large doses are necessary, 10 to 13 grams of cinchophen, 11 to 16 grams of neocinchophen

to obtain complete relief in rheumatic fever. Such large doses may produce symptoms of salicylism but they are less pronounced than those caused by the salicylates. Both drugs slowed the heart rate. Cinchophen caused pain in the stomach in some patients, which was relieved by combining it with bicarbonate of soda, and also caused renal irritation as a rule. Neocinchophen was, to a large extent, free of both of these objectionable features. Either drug may be administered in doses of one gram every hour until salicylism develops, or the symptoms are relieved.

Protein Shock.—The intravenous injection of protein in the form of serum, bacterial vaccines or milk has been practised, but is not more satisfactory than the efficient administration of the salicylates.

Serum.—Antistreptococcic serum has been injected intramuscularly and intravenously, but its use is unsatisfactory, and if beneficial action is observed, it is probably only that of the foreign protein used.

There is no specific remedy, unless the administration of salicylates may be so called.

Complications.—In all cardiac complications prolonged rest in bed is important, and is practically all that may be done. An ice bag may be applied to the precordial region. When the patient begins to get up, he should very slowly increase the daily exertion; and some months should pass during which the patient is gradually regaining cardiac function.

XX. YELLOW FEVER.

The effort is now being made by the Yellow Fever Commission of the International Health Board and the Rockefeller Foundation to wipe out yellow fever. It is to be hoped that their efforts may be successful, and that the disease may become a matter of medical history.

Prevention.—**Community.**—Epidemics of yellow fever depend upon three factors—a case of the disease, the mosquito, *stegomyia fasciata*, and a susceptible population. But one link of this chain need be broken to stop an epidemic or prevent its occurrence.

The elimination of yellow fever from the large cities of the tropics, which have been its foci in the past, has depended almost entirely upon preventing the breeding of the *stegomyia fasciata*. The reduction in numbers of this mosquito is followed at once by fewer cases of yellow fever. Its elimination is accomplished by a careful inspection of all fresh water in and about the city. Water storage tanks are screened by fine mesh wire (18 mesh), and in some instances are stocked with small fish. Ponds and puddles are drained or coated with oil or with the larvicide described in the chapter on dengue. Buckets, tin cans, faulty roof gutters and drains are searched out and made impossible for breeding purposes. Live mosquitoes in homes are killed by fumigation.

Attempts to control the disease by isolating persons sick of the disease, thus breaking the first link of the chain, have proven ineffectual, because cases were reported late, and it was found impossible to control them in

time to prevent their infection of mosquitoes. The third link in the chain, the non-immune, cannot be controlled because of the intercourse of commerce.

Personal Prevention.—Persons living in districts where yellow fever is endemic should reside in carefully screened houses, and they should take care that mosquitoes do not breed in the house. If possible, it is best that the residence be on high land, and that the sleeping quarters are in the upper part of the house. The culpable mosquito, *stegomyia fasciata* is most active early in the morning, or from three to ten in the evening. According to Carroll, persons may venture into yellow fever districts from nine in the morning to three in the afternoon with slight danger of infection. If it be necessary to go out after these hours, gauntlets, leggings and head-net should be worn.

Active Immunization.—The recent work of Noguchi has pointed the way to a method of active immunization which may prove of great value in the prevention of yellow fever. During several years he has studied the effects of the injection of a vaccine made of cultures of *Spirochetæ Icteroides*. The strength of the vaccine has recently been changed to two billion organisms per cubic centimeter, and this was injected in about 7500 susceptible individuals. Of these 3230 had two injections, the course advised; eighteen persons developed yellow fever within ten days of the last injection; none developed it after one month had passed. Of 3724 individuals who received but one injection of the vaccine, eight developed the disease within ten days, probably infected before the immunizing dose; and five developed it in one to three months. In both instances the incidence of yellow fever in the unvaccinated population was considerably higher than in those immunized with either one or two doses of vaccine.

These figures appear to give much promise of another method of effective control of yellow fever which will assist materially the mosquito elimination.

Treatment.—**General Management.**—Rest in bed from the onset, and until convalescence is well established, is essential. The bed pan and urinal are to be used and the patient must be spared every exertion.

Food.—Both Carroll and Carter believe that no food of any kind should be given for the first four or five days of the disease. After that rice water, the juice of oysters, chicken soup and the grated yolk of hard boiled egg are advised. Carter says milk is likely to upset the stomach. After the temperature has been normal for three days the diet may be rapidly returned to one that will provide sufficient nourishment.

Water should be pushed from the first day, given in small sips and at frequent intervals. A mildly alkaline water is best, such as Vichy, or any mineral water may be used, and to each pint is added two grams (30 grains) of sodium bicarbonate. It is best given ice cold. If not enough fluid can be taken by mouth, tap water must be given by rectum.

Bowels.—An initial purge of calomel and a mild saline is administered at the onset of the disease. There should, during the disease, be a daily movement, an enema being given if necessary.

Fever.—Cold sponging is best. Carroll advises that sponges be given every hour. A wet pack or a cold bath may also be used.

Pain.—Headache early in the disease is controlled by an ice cap or by acetphenedetin 0.3 gram (5 grains). Backache is often very severe and is best relieved by an injection of morphine.

Vomiting.—The “black vomit” is best prevented by withholding food. Marked tenderness over the stomach and hiccough are its precursors. When they occur Carter advises the administration of cocaine hydrochloride 0.03 to 0.06 gram ($\frac{1}{2}$ to 1 grain) in capsule. If vomiting has begun, a course of calomel and a high enema are given. A small mustard plaster to the epigastrium may be effective.

Uræmic Symptoms.—The free administration of water during the earlier stages of the disease and keeping the urinary excretion high is the best preventive of uræmia. Should oliguria with uræmic symptoms occur the patient should be given hot packs, the bowels should be freely moved and high hot colon irrigations be given. Water should be continued by mouth unless there is intractable vomiting.

Specific Treatment.—Noguchi has tried the administration of arsphenamine and has found it ineffectual.

Passive Immunity.—A serum of high potency has been developed, and its use in 170 cases of yellow fever reported upon by Noguchi. The strength of the serum is such that 0.001 cubic centimeters neutralized 5000 minimum lethal doses, for the guinea pig, of *leptospira icteroides*. It is made of the serum of horses and the usual precautions against anaphylaxis must therefore be taken. Of the 170 cases, 95 were treated on or before the third day, with a mortality of 13.6 per cent., and 75 were treated after the fourth day, with a mortality of 52 per cent. Of 783 cases of yellow fever occurring during the same epidemic 56.4 per cent. died. This would indicate that the serum is of considerable efficacy, when used early in the disease.

XXI. ASIATIC CHOLERA.

Epidemics of cholera of any extent are due to the contamination of drinking water. Smaller groups of cases are due to the infection of food.

Prevention.—Community measures to be taken for the prevention of cholera in a community are exactly similar to those which are effective in preventing typhoid fever.

Health authorities are usually responsible for the water supply and for the control of foods which may be infectious, such as uncooked vegetables, milk and shell-fish. In any community, where the power of the health officers is not sufficient to strictly enforce proper regulations, such officers should at least warn the inhabitants of the danger of infection, so that personal measures of prevention may be thoroughly carried out.

Personal Prevention.—In the presence of epidemics the problem is again that of cleanliness in regard to “food, fingers and flies.” Water and milk should be boiled, and no raw foods, with the possible exception of

fruits, which may be carefully washed in boiled water and peeled, should be eaten. The advice to "eat only hot food" is good, as it may be contaminated after cooking and cooling.

ACTIVE IMMUNIZATION.—The use of vaccines in the prevention of cholera in exposed persons has been practised for many years, first in Spain, by Ferran, and later, in India, by Haffkine. During the Great War many soldiers were exposed to cholera and were immunized by vaccine injections. The incidence of cholera in these men was less than that in the civilian population amongst whom they lived, and was considered evidence that considerable immunity was produced. It is believed that the immunity is not as complete, nor of such duration, as that produced by typhoid vaccination. After vaccination most people are immune for three months, and some for six months. Its use would therefore be indicated only in the presence of an epidemic, and in no case should it take the place of careful sanitation. The vaccine advised by Teague is a suspension of cholera vibrios in normal salt solution, killed by heat at 53° C. for one hour, and so standardized that it contains 8000 million organisms in each cubic centimeter. In India two subcutaneous injections are given with an interval of one week between injections. The first is 0.5 cubic centimeters, and the second 1.0 cubic centimeter. The reaction is said to be mild.

The Patient.—Efficient control of epidemics of any infectious disease of the food-borne group, must begin with the patient. Cholera vibrios are disseminated by the intestinal discharges in great numbers and rarely by the urine and vomitus. These must be then carefully disinfected, and the same methods as those used in typhoid fever are effective. The bed and night-clothing must also be disinfected. Every patient should be carefully screened to prevent access of flies.

During epidemics of cholera, healthy carriers of the organisms have been found. They should, at least, be prevented from engaging in any food-handling business, and it may be advisable to confine them.

Treatment.—The patient should be sent to a special hospital, where he will receive better care and be least menacing to the community, because of more thorough disinfection of the discharges. In the treatment of the disease two problems are to be met—the restoration of body fluids and the prevention of uræmia. There is no specific treatment.

General Management.—The patient is put to bed at once, and the body heat conserved by an extra blanket and hot water bottles. Warm sponges should be given for cleansing purposes only when necessary.

Diet.—In the earlier stages only light liquids are allowed, such as boiled milk and egg albumin water. As the stage of collapse sets in with its severe purging and vomiting, all food is withheld. With the stage of reaction small amounts of liquid food are again allowed, and, as the patient improves, the food is cautiously increased to a soft diet.

Water by mouth is given throughout the disease in as large amounts as the patient can take without vomiting.

Vomiting.—The stomach may be washed out with a weak, 2 per cent. sodium bicarbonate solution. A mustard plaster is applied to the epigastrium. Small pieces of ice are held in the mouth, and cocaine hydrochloride 0.008 gram ($\frac{1}{8}$ grain) may be administered orally.

Circulation.—The best circulatory stimulant is a replacement of fluids. Drugs by mouth are of doubtful value because the stomach frequently rejects them. Sellards says strong coffee may be retained and its caffeine may be of value as a stimulant. The solution of hypophysis may be used hypodermatically or a suitable preparation of digitalis may be injected.

Pain.—Severe epigastric pain may be controlled by morphine sulphate, although many writers advise against the use of opiates.

Drugs given by mouth, with the object of controlling the diarrhœa, are valueless; and do harm in that they often provoke vomiting.

Potassium permanganate, 0.13 grain (2 grains) in keratin-coated pills, given every fifteen minutes for two to four hours, and then every half hour until the stool becomes green, has been highly recommended.

REPLACEMENT OF BODY FLUIDS.—The tremendous loss of body fluid apparently causes a condition of acidosis similar to that seen in babies with severe diarrhœa. Both Rogers and Sellards advise that fluids be replaced by the intravenous injection of large amounts of various solutions of sodium chloride and sodium bicarbonate.

Sellards advises that all patients in the stage of collapse receive, every six to eight hours, two quarts of a solution containing sodium chloride and sodium bicarbonate, each in 0.5 per cent., strength. Early in the stage of reaction a 1.5 per cent solution of sodium bicarbonate is used, and, if the urine be low in amount, or its acid reaction persist, a 2 per cent. sodium bicarbonate solution is used. In uræmic cases he gives the patient intravenously 60 to 90 grams (2 to 3 ounces) of bicarbonate in each twenty-four hours. Hot packs and sweats are said to influence the patient unfavorably.

XXII. BACILLARY DYSENTERY.

Epidemics of bacillary dysentery are brought about in much the same way as are those of typhoid fever. Water does not, as a rule, play so large a part in infecting groups of individuals, while the hand to mouth infection is of considerably more importance. Attendants in wards are much more liable to infection, and in camps, it is believed, the men are infected by fouled earth, transported on the shoes from the latrines to the tent floor, and from there to the hands and mouth.

Prevention.—The prevention is similar to the prophylaxis of typhoid fever. It is again a question of "food, fingers and flies."

The Patient.—The bacillus is found in the stools in great numbers, very rarely in the urine. These must both, therefore, be disinfected with cresol solution as is necessary in typhoid fever. Bed and night clothing, whether grossly soiled or not, must be disinfected before being sent to the laundry. Care must be taken that bed pan and urinal are disinfected. The

patient should be screened. It is extremely important that nurse, physician, and attendant upon a case of dysentery wash their hands, or soak them carefully in disinfectant solution, after each handling of the patient.

No patient with dysentery should be discharged until three successive negative cultures of the stool have been taken during fourteen days.

Personal Prevention.—Avoidance of unboiled water and milk, and of fresh vegetables, careful scrubbing of the hands before each meal, and immediately after association with a dysentery patient, and keeping flies away from food are the essential measures to be taken for the personal avoidance of infection.

Active Immunization.—The injection of a vaccine made from dysentery bacilli produces an active immunity to the disease. It is, however, unsatisfactory for two reasons—because of its severe local reaction, and because the immunity is of but two or three months duration.

Passive Immunization.—The antiserum for either of the specific organisms, Shiga or Flexner, or a mixture of both sera may be used when there are outbreaks of dysentery in institutions, to produce a passive immunity. The dose is 5 cubic centimeters (75 minims) injected subcutaneously, after the usual precautionary measures with regard to the use of horse serum. Immunity thus produced lasts only ten to twelve days.

Treatment.—**General Management.**—Rest in bed from the onset is imperative to conserve the strength and to lessen peristaltic stimulation. The body heat is conserved by hot water bottles and an extra blanket. A woollen abdominal band, with a light hot water bag or an electric pad, is very grateful to most patients.

Diet.—Throughout the disease there is an acute intestinal ulceration which must be irritated as little as possible. Usually, during the first day or two, only water is allowed. Then tea with or without lactose, broths, egg albumin, whey and gruels may be given. Milk is said to be poorly borne and causes a great deal of fermentation.

As convalescence is established the patient is allowed more food, but the increases are made very slowly to prevent relapse. Milk is first added, then toast, simple milk desserts, cooked vegetables, and finally there is a return to the normal diet.

Bowels.—A purgative at the onset is usually advised. This may be castor oil, but many men prefer sodium sulphate 2 to 4 grams (30 to 60 grains) every hour until there is free purgation. At any time that there is solid faecal matter passed, the bowels should be moved with salines to prevent irritation of the ulcerated intestinal mucosa.

After the initial purgation, bismuth subnitrate in large doses, or kaolin suspended in water is given daily for its absorbing action upon the toxins.

Pain.—Abdominal pain due to tenesmus may be relieved by a hypodermic injection of morphine sulphate 0.015 gram ($\frac{1}{4}$ grain). Atropin, in small doses, relaxes spasm of the involuntary intestinal muscle fibres, and is useful in the colicky pains of dysentery; 0.3 milligram ($\frac{1}{200}$ grain) may be administered orally until there is dryness of the mouth.

Proctoclysis.—The lower colon may be irrigated with one of several solutions; plain normal saline, a weak (1 or 2 per cent.) sodium bicarbonate solution, or boric acid in saturated solution. The tube must be inserted gently and the fluid injected at body temperature and very slowly. In very acute cases rectal irrigation cannot usually be done.

Causal Treatment.—Serum.—Each type of dysentery bacillus, Shiga or Flexner, upon injection into the horse, produces its own immune bodies in the horse serum. There have been thus developed two specific sera, neither of which has any action upon the other type organism, though a mixed serum, for the treatment of either type disease may be purchased.

With adequate facilities for the accurate determination of type monovalent sera should be used. In the absence of such facilities the polyvalent serum may be injected.

Dosage.—The average adult dose is 20 cubic centimeters, injected subcutaneously. This often suffices, but in severe cases further injections are frequently necessary. In very severe cases the serum should be injected intravenously, and the dose is then 50 to 100 cubic centimeters. In all cases the patient should be desensitized for a possible horse serum sensitiveness.

Complications.—Chronic Dysentery.—Patients with chronic dysentery should be in bed and be kept quiet and warm. Local treatment is most efficacious. The bowel is first washed out with normal salt solution and then with a 1 to 5000 solution of silver nitrate.

Neuritis is treated as is usual when the affection is primary.

Arthritis very rarely goes on to suppuration. The painful joint is immobilized upon a light splint and heat is applied.

XXIII. PLAGUE.

Infection with *bacillus pestis* is usually through the bite of the rat flea, but in exceptional cases it may occur by ingestion of infected material, or by abrasion of the skin. In the pneumonic form infection occurs by direct inhalation from a person ill of the disease.

Prevention.—The one measure so far found effective in stopping an epidemic of bubonic plague is the extermination of the rat population of the infected community. This is best accomplished by the cleaning up of all buildings, outhouses, and trash piles, and the insistence by the building authorities that all new buildings shall be of rat-proof construction. Poisoning and trapping may also be tried, but the rat population drops most rapidly when it is unable to obtain food. Precautions must also be taken to prevent the landing, in clean ports, of the rats of ships from plague-infested ports. The crews of such ships may be held for five to ten days to allow the usual incubation period of plague to pass. The ship, itself, should be thoroughly fumigated.

The patient with plague should be isolated and in a place where he is unable to infect rats. The stools and urine should always be disinfected, as

they are contaminated with *bacillus pestis*. The sputum in every case, bubonic or pneumonic, should be burned, as should the discharges and dressings used on broken-down buboes.

Personal prevention is mainly concerned with the inoculation of vaccines when it may be necessary to enter a country where plague is epidemic. When contact with cases of pneumonic plague is necessary, a mask and goggles must be worn.

Protective Inoculation.—A vaccine to protect against the disease was first used by Haffkine in 1897. His vaccine, a killed broth culture, was used in a single dose and caused a severe reaction. Now the culture from an agar slant is suspended in salt solution, and killed by heat. It is estimated that the active immunity thus produced reduces the chances of infection with *bacillus pestis* about four-fifths, and those who contract plague after inoculation have two and one-half times better chance for recovery.

Treatment.—Confinement to bed is necessary and the patient should be carefully nursed. Fever is treated by sponging or cold packs. Pain should be controlled by an injection of morphine, 0.015 gram, ($\frac{1}{4}$ grain) repeated as necessary. It is important to maintain the caloric intake with easily assimilable food. Stimulation of the circulation is usually necessary from the onset.

BUBOES.—An ice cap may be applied. Injections of bichloride of mercury into the bubo have been advised. After suppuration and discharge, the lesion must be treated aseptically to limit secondary infection. Irrigation with Dakin's solution has been suggested.

Causal Therapy.—An antiplague serum, known as Yersin-Roux serum, has been prepared, and reports indicate that it reduces the mortality to about 25 per cent. when administered early in large doses. It is given intravenously in doses of 100 to 150 cubic centimeters, and the same dose is repeated every 12 to 24 hours until recovery is assured. The usual precautions against sensitization to horse serum must be observed.

XXIV. MALTA FEVER.

Malta fever is due to infection by the *micrococcus melitensis* which gains entrance practically always by way of the gastro-intestinal tract, and usually through the agency of goat's milk or its products. The *micrococcus melitensis* is eliminated from the body mainly through the urine, but it is found at times in the feces. In dust it will live for eighty days, and in water for thirty days.

Prevention.—The work of the British Admiralty Commission of 1904 previously showed that by the elimination of raw goat's milk from the diet the disease does not occur in groups of individuals.

The mild ambulatory case or carrier may assume importance when he is associated with the handling of food. Food, fingers and flies are possible methods of transmission of the disease.

The urine and fæces of the patient should be carefully disinfected to prevent the contamination of foliage and of water.

Active Immunity.—A protective vaccine has been advocated by Castellani. Two doses are given at weekly intervals. The first dose contains 2000 million micrococci, the second 4000 million, and both are injected subcutaneously.

Treatment.—The patient should be kept in bed throughout the attack. Careful nursing is important. The food need not necessarily be liquid but should be easily assimilable and the caloric intake should be high. The bowels may be obstinately constipated and should be moved by a daily enema. Fever is best controlled by cold sponges or packs given every four hours when the temperature reaches 103° F. or more.

Pain may be severe and should be relieved. The salicylates or pyramidon may be tried, but are usually insufficient, and when such is the case opium may be given. The physician must use a large amount of discretion in the administration of opium to these cases, because it must be repeated, and there have been many cases of opium habit following Malta fever. Sleeplessness responds to the bromides or chloral.

Debility, anæmia, and the mental depression which so frequently follow attacks of Malta fever improve most rapidly when the patient spends some months in another climate.

Causal Therapy.—Sargent and L'heritier have developed an immune serum from the horse which they claim is especially efficacious in the chronic painful forms of Malta fever. The dose advised is 50 cubic centimeters, intravenously, given on each of three successive days.

In the long continued cases with low fever an autogenous vaccine may be given, either subcutaneously or intravenously, in small doses.

XXV. TETANUS.

Tetanus bacilli in the body act in a manner similar to that of diphtheria bacilli. In either case there is a local growth of micro-organisms, elaborating a virulent toxin, which is absorbed into the blood stream and produces then the symptoms of the disease. In tetanus, the end plates of the motor nerves first absorb the poison from the blood; it ascends the motor nerve fibres and, upon reaching the motor nerve cells of brain or spinal cord, produces the characteristic symptoms of the disease. Tetanus bacilli practically always gain entrance to the body through an opening in the skin. They grow best in deep wounds or those from which air is excluded, as under the finger or toe nails. The period between inoculation of bacilli and symptoms of the disease is extremely variable. Bruce's figures, from 1000 cases in which the incubation period was considered, showed that in most, symptoms occurred on the ninth day, and that the extremes were two days and one year. Furthermore, the bacilli or their spores may lie dormant in the tissue about healed wounds for long periods, to be activated by surgical procedure or even other manipulations of the part.

Prevention.—The prevention of tetanus must be considered from two standpoints—the surgical care of the wound, and the production of a passive immunity by tetanus antitoxin.

SURGERY.—Every opening through the skin which has been contaminated with stable or street dirt or with manure-fertilized earth, any wound occurring in regions in which infection by tetanus bacilli has been frequent, or any wound attended with devitalization of tissues, must be thoroughly opened up, all the devitalized tissue and dirt removed, and swabbed out with three per cent. tincture of iodine. The wound must then be kept open and draining freely until healthy granulations have formed.

PASSIVE IMMUNITY.—All cases in which there is a possibility of infection by tetanus bacilli, and all cases in which there have been deep or extensive wounds, with crushing and devitalization of tissues, should receive 1500 units of tetanus antitoxin, best given as an intramuscular injection, and, whenever possible, injected into the muscles in the neighborhood of the injury. As it is known that tetanus bacilli may lie dormant for several weeks, until they begin to grow and elaborate toxin, the prophylactic inoculation should be repeated at weekly intervals in the same sized dose until healthy granulations have formed throughout the wound.

Two lessons of the Great War with regard to tetanus should not be forgotten—late secondary or deferred operations upon healed wounds, and trench foot.

If a re-operation is to be done upon a patient with a healed but primarily badly infected wound, a prophylactic dose of tetanus antitoxin should be given twenty-four hours before the operation.

Devitalization of tissues occurring under circumstances similar to those causing trench foot—standing or walking in cold mud to the knees for hours at a time—may lead to tetanus. Men with lesions of this character should receive a prophylactic injection of tetanus antitoxin.

Treatment.—The treatment of fully developed tetanus, still rather unsatisfactory, depends mainly upon the use of tetanus antitoxin.

General Management.—The patient should be put to bed in the quietest part of the house or hospital. He should not be disturbed by any bright light or noises. But one attendant is necessary and no other person should be about. After the diagnosis is made, the physician should disturb the patient only for the necessary treatments.

Food.—In many cases, inability to open the mouth may make nasal or, at times, rectal feeding necessary. The nourishment is usually necessarily liquids, and these must be of high caloric value and administered at long intervals, so that the patient need be disturbed but seldom.

Hyperexcitability.—The patient must be spared every possible manipulation. Bathing should be done only when necessary. Drugs should be used to depress the function of the spinal cord. Chloral in doses of 3 to 6 grams (45 to 90 grains) daily, and usually combined with bromides, may be given by mouth or by rectum. Chloroform may be used for the convulsions,

and when the daily dressing of a severe or painful wound is essential, it is usually best to chloroform the patient.

Causal Therapy.—The consensus of opinion is that tetanus antitoxin, used in large doses immediately after appearance of the symptoms, has reduced the mortality of the disease. Every hour lost decreases chances for recovery. But two methods of administration of antitoxin may be considered—intravenous and intraspinous—and both should be used. Neither the subcutaneous nor the intramuscular injection is absorbed rapidly enough. Sherrington's experiments with monkeys infected with tetanus bacilli and with symptoms of the disease are summarized as follows:—

10 monkeys, no antitoxin.....	10 deaths
10 monkeys, subcutaneous antitoxin.....	10 deaths
12 monkeys, intramuscular antitoxin.....	12 deaths
16 monkeys, intravenous antitoxin.....	10 deaths (62.5 per cent.)
18 monkeys, intraspinous antitoxin.....	5 deaths (27.7 per cent.)

INTRAVENOUS INJECTION.—The advantage of giving antitoxin by vein is that the circulating toxin is immediately neutralized, thus preventing further nerve damage. The dose should be 15,000 to 25,000 units (Ashhurst) and this dose may be repeated once after twenty-four hours. Time lost in desensitizing the patient may bring about a fatal outcome, so if anaphylaxis is feared, the dose of antitetanic serum may be diluted to 50 cubic centimeters, with normal saline solution, and 1 cubic centimeter of the mixture given; in four minutes 3 cubic centimeters is given; in two minutes more 10 cubic centimeters; in a further two minutes 25 cubic centimeters; and in ten minutes the remainder.

Intraspinous Administration.—Tetanus toxin is, supposedly, firmly bound to nerve cells, but it has been shown clinically that antitoxin, intraspiously, is of value in the treatment of tetanus. Given in this way it reaches all nerves and neutralizes the toxin in the spinal cord. The dose is 3000 to 10,000 units, depending upon the size of the patient, and it should be repeated every twelve hours until there is improvement.

TECHNIC.—The patient is chloroformed. If, after insertion of the needle, fluid flows freely, intermeningeal pressure is relieved. The antitoxin then, diluted or undiluted, is allowed to flow in by gravity. The dose should be 5 to 10 cubic centimeters less than the amount of fluid which was withdrawn. Nicoll advises diluting the serum, with the idea that it will then be more uniformly distributed in the intermeningeal space.

XXVI. HYDROPHOBIA.

Hydrophobia is a rather unusual disease, the incidence of which in man closely follows the rate of infection in dogs. It is not seen in countries in which a strict six months quarantine law against the admission of dogs is enforced.

The mortality, after the development of symptoms, in man is 100 per cent. Of 5134 persons in New York City, presumably infected with rabies and given the preventive inoculation of the New York City Health Department, there was a total mortality of 0.39 per cent.

Prevention.—The most important factors in the prevention of the disease in man are measures directed toward eliminating the infection of animals. In England a rigid six months detention law against the importation of dogs has practically stamped out the disease. Few countries have the natural advantages of England for the enforcement of such laws, but strict regulations for the efficient muzzling of all dogs may be enforced.

Treatment of Bites by Animals.—As a matter of prevention of the ordinary infections every bite by an animal should be thoroughly cauterized, opening the wound widely, if necessary, to allow access to its deeper parts. If there is any suspicion that the animal had hydrophobia, special care should be taken and the wound should be swabbed out with fuming nitric acid. Pure carbolic acid followed by alcohol may be used, but it is not as efficient as the nitric acid.

The animal responsible for the bite, if apparently healthy, should be kept under observation for three weeks, and if still healthy, no further treatment need be given the person bitten. If the dog is sick or should he develop rabies, the head should be cut off, packed in ice, and sent to the nearest laboratory, usually a State laboratory, for examination of the brain for Negri bodies.

In man, the incubation period of rabies is usually three to eight weeks. In rare cases it may be as short as eight days, or symptoms may not appear for three months or more. This relatively long incubation period is the only reason for the value of preventive inoculation, and no time should be lost in starting the production of an active immunity.

Specific Immunity.—In 1885 Pasteur brought into use the production of an active immunity to hydrophobia in those exposed to the disease. He passed the virus of the disease through a series of rabbits, until a virus was obtained which produced symptoms of the disease regularly in seven days after inoculation. A number of rabbits were then inoculated with this virus and all were killed on the seventh day. The spinal cords were then removed aseptically, and dried for a varying number of days, the cords containing the most attenuated virus undergoing the longest drying period. The cords were made into emulsions and are used for daily subcutaneous inoculation, beginning with a weak dose and gradually increasing to a strong dose of the virus. The usual course of inoculations extends over twenty-one days, and immunity is at its maximum about two weeks after the last inoculation. The course of treatments may be procured from most city or state health authorities and from the United States Public Health Service.

Indications for the use of preventive treatment are present when the following conditions are fulfilled:

1. Definite evidence of rabies in the animal. In extensive bites; bites about the head; when there is any suspicion of rabies in the animal and the animal is not available.

2. Following animal bites in districts where the disease is prevalent, but the animal cannot be secured for examination or the brain

is decomposed. Following the bites of wild animals, especially the wolf and the skunk.

3. When rabies develops in the apparently healthy animal which is kept under observation.

It has been estimated that, after inoculation for the prevention of rabies, less than one in 10,000 persons die—apparently due to the inoculation. It is believed that these persons are more than usually susceptible to rabies virus, and this view is strengthened by the fact that most of the deaths have followed intensive inoculations. It should, in no instance, have any influence upon the giving of the preventive treatment.

Treatment of Hydrophobia.—All cases die, and only symptomatic treatment can be given, usually directed at lessening the spasms.

The patient should be in a quiet warm room and be disturbed only when absolutely necessary. Chloral hydrate may be administered in large doses per rectum. Chloroform inhalations may be used to control the spasms, and morphine sulphate should be administered in amounts sufficient to quiet the patient. The pharynx and larynx may be painted with a solution of cocaine to relax spasm. An attempt should be made to maintain water and food intake, water being given continuously by rectal drip.

XXVII. GLANDERS.

Glanders is an acute infectious disease caused by the *bacillus mallei*, and practically always seen in men who handle horses. The bacillus does not resist drying, and outside of the body it soon dies.

Prevention.—The important preventive measures are those which reduce the incidence of the disease in horses and mules. Probably the most important of these is the abolition of the common drinking trough, and the insistence that each horse, outside of his own stables, have his own drinking pail. The mallein test has furnished an excellent diagnostic method for detection of the disease in horses. When a glandered horse is found, it should be destroyed. Men who handle horses probably contract the disease by carrying the bacteria on the hands to the nose or mouth.

Treatment.—If the initial glanders nodule is recognized, it should be excised, and the base cauterized with pure phenol, followed by alcohol. When the disease has become generalized the treatment can be but symptomatic. Chronic deep abscesses and the farcy buds should be opened and then drained.

Causal Therapy.—**Vaccines.**—Vaccines have not been satisfactory. In two cases of glanders, which were reported by Potter and came under my observation, vaccines were used without any effect upon either the symptoms or course of the disease. Both patients died.

Serum.—The serum of normal or of immunized animals has been used but the results have not been satisfactory.

In animals, recovery has followed the repeated use of small doses of mallein, but this has not yet been tried in man.

XXVIII. ACTINOMYCOSIS.

Actinomycosis is due to a specific organism, the *streptothrix actinomyces bovis*. The infection in man probably occurs from diseased domestic animals. The disease is unusual, but is seen most frequently in men who handle cattle. The method by which the organism gains entrance to the body is not known, but with the varied clinical picture it seems probable that respiratory, gastro-intestinal tract and the skin may all be inoculated.

Prevention.—There is no especial preventive treatment. The hands should be carefully washed after handling animals, and during work with grain in which there is much dust, an efficient respirator should be worn.

Treatment.—Surgery should be the main reliance in the treatment of actinomycosis, but the thorough excision of the lesion is impossible when vital structures are involved. In any case free drainage should be established and, if possible, the lesion should be left open and accessible to daily local treatment. The local application of silver nitrate in ten per cent. solution, of ten per cent. formalin in glycerine, and of tincture of iodine, have all been used with varying success. Solutions of silver nitrate, 3 to 5 per cent., and of tincture of iodine have been injected into the mass.

Internally, potassium iodide is the drug of choice, and a few patients have recovered with the use of this drug and without any other measures. The dosage should be as much as can be borne, and a daily amount of 15 grams (240 grains) has been advised. The drug should be started at doses of 1 gram (15 grains) three times daily, and this is increased to tolerance. It should always be well diluted with water or with milk, and its use should be continued for long periods before it is discontinued as valueless.

Specific Therapy.—The use of vaccines has been advocated. They are extremely difficult to prepare, standardize and sterilize. Usually the culture is ground, and then diluted with normal saline solution to the density of a suspension of staphylococci, one billion per cubic centimeter. The dose at first is 0.1 cubic centimeter, injected subcutaneously.

The use of vaccines has not yet been extensive enough to enable one to give a definite valuation to the treatment, but in cases where complete excision is impossible, they should be tried with the potassium iodide.

XXIX. ANTHRAX.

Men engaged in the handling and preparation of the skins or hair of cattle, sheep or horses not infrequently develop anthrax. In the general population the disease is rare, though during the past few years its occurrence has been reported as following the use of new horsehair shaving brushes.

Prevention.—In order that the employes in the hide and hair industries may be protected from infection by anthrax bacilli, some method of sterilization of the raw material is essential. Horsehair and bristles should be exposed to live steam, which will lessen the risk of handling materially. Hides are usually subjected to the "formic mercury process" which renders them comparatively innocuous and does not injure them.

Employees in all such industries should wear gloves, overalls and, when there is dust, a respirator. The hands and nails should be carefully scrubbed on leaving work.

New shaving brushes may be soaked in ten per cent. formalin solution, which is kept at a temperature of 110° F., for four hours (Mueller).

Animals may be effectively immunized to anthrax infection by the injection of a vaccine made of attenuated organisms.

Treatment.—There are two dissimilar methods of treating human anthrax, based upon the opinion held as to whether the disease is simply a local lesion which becomes a general infection later, or whether anthrax is a general infection from the start. The idea that anthrax is a local lesion early accounts for the surgical treatment—wide excision by knife or cautery and the application of a wet antiseptic dressing of dichloramin-T or alcohol and water.

A number of observers have claimed that better results have followed the non-surgical treatment of anthrax. The patient is simply put to bed; a splint is applied to the infected part when possible; the pustule is covered with a simple dressing or is exposed to the light; and a light diet and plenty of fluids are taken internally. Scholl¹ has collected fifty-one cases from the records of the Massachusetts General Hospital. Nine were treated surgically, and of these four died. Forty-two were treated non-surgically, and but three of these patients died.

Kolmer summarizes the treatment employed at the Philadelphia Hospital for Contagious Diseases, and states that he has seen good results:

1. A blood culture.
2. Antianthrax serum by muscle or vein.
3. Wide excision of the pustule under a general anæsthetic and with as little manipulation as possible.
4. Antiseptics to the wound—a mixture of powdered calomel and powdered ipecac is dusted on freely. (Muskett in 1888 demonstrated that powdered ipecac rapidly destroys anthrax bacilli).
5. With a positive blood culture, 100 to 200 cubic centimeters of antianthrax serum are given intravenously, every 12 to 24 hours, until the blood culture is negative.

Kraus, in the Argentine has recommended the subcutaneous injection of normal beef serum, heated twice to 56° C. for sterilization. Thirty to fifty cubic centimeters are injected subcutaneously every 12, 24, or 36 hours, depending upon the severity of the case. He reports 146 cases so treated with but one death.

Casual Therapy.—Sclavo's serum has been used extensively in Europe since 1895. It is the blood serum of asses which have been immunized to anthrax, and is given in doses of 30 to 40 cubic centimeters, injected in four or five places in the anterior abdominal wall. In severe cases, it has been used in larger amounts intravenously.

The United States Department of Agriculture has prepared an anti-anthrax serum from immunized sheep, and a globulin fraction of the same

blood serum. The dose of the serum is 40 cubic centimeters, of the globulin fraction 10 to 15 cubic centimeters. Both are injected intramuscularly or in the tissues about the lesion. In severe cases, larger amounts of the globulin fraction, 30 to 50 cubic centimeters, may be injected intravenously.

Regan and Regan have claimed very good results from the use of anti-anthrax serum injected into the tissues about the anthrax pustule.

XXX. LEPROSY.

The factors in the transmission of leprosy are not yet thoroughly understood but apparently, the closest and most intimate contact is necessary for its contraction.

Prevention.—Because of the generally accepted hopelessness of its cure, and partly because of the universal horror of the disease, individuals affected with leprosy are, at least in the modern world, closely segregated. The attendants to such patients do not appear to contract the disease except in rare instances. The mode of transmission of the *bacillus lepræ* is not known, but it is believed by many that the initial lesion is in the nasal mucous membrane; and this suggests that the infection is transmitted there by the hand, possibly by inspired infected air. Until more is known about the transmission of leprosy, it is best that all cases be closely segregated.

Treatment.—The general hygiene of the patient and of his surroundings is important. Frequent baths are essential, and a frequent change of clean linen should be provided. The food should be varied, simple, and nourishing. The bowels should move daily, constipation to be corrected by regulation of the diet if possible, otherwise by a simple laxative. Nose, teeth and throat should be cleansed daily.

Local Treatment.—The open ulcers must be aseptically cared for so that secondary infections are prevented. Pus collections should be drained and the amputation of fingers or toes may be necessary.

General Treatment.—For some years chaulmoogra oil has been used with apparent success in the treatment of leprosy. It is administered by hypodermatic injection twice weekly, beginning with a dose of 0.5 cubic centimeters, and the dose is gradually increased to 1.5 or 2.0 cubic centimeters. The chaulmoogra oil is mixed in an emulsion with camphorated oil and resorcin, (chaulmoogra oil 60 cubic centimeters, camphorated oil 60 cubic centimeters and resorcin 4 grams), put up into vials and sterilized.

During the past two or three years, the fatty acids from chaulmoogra oil, *sodium gynocardate*, and from cod liver oil, *sodium morrhuate*, have been used in the treatment of leprosy. Apparently, the effect has been better than with the crude drug, but sufficient time has not elapsed in the apparently cured cases to determine that the disease has really terminated in these patients.

XXXI. TUBERCULOSIS.

J. C. WILSON.

Tuberculosis, in its various aspects, has been known and described since the earliest periods of medical history. It is today prevalent in every part of the civilized world, and of all diseases the most destructive to human health and life. It is, therefore, no matter for surprise that there is an enormous literature concerning it, the greater bulk of which has accumulated since the epoch-making discovery of the tubercle bacillus by Robert Koch (1882). This discovery, of transcendent importance to the human race, settled at once all question as to the infectious nature of the disease; established the essential identity of its multiform manifestations; and pointed out the long and tedious, but by no means hopeless, course by which ultimate relief from this scourge of mankind may be obtained.

The scope of the present work renders any extended review of this great subject impossible. The following pages, therefore, are devoted to the presentation, in a concise manner, of the facts available for the requirements of the worker in the field of preventive medicine on the one hand, and the student and practitioner, in that of applied therapeutics, on the other. The reader who seeks more detailed information is referred to the treatises on the general subject and the monographs on its special phases.

Preventive Treatment.

The prophylaxis, in tuberculosis, is general, as concerns society at large, and particular as regards the individual.

General Prophylaxis.—This constitutes the most important subject to which preventive medicine has, at the present day, given its attention. An intelligent and effective crusade against this disease demands a working knowledge of its natural history. The outstanding facts are that tuberculosis is an infection; that it is transmissible; and that it is a preventable disease.

The Infection.—The bacilli are found in all tuberculous lesions, but in varying numbers. They are especially abundant in those undergoing active development with ulceration, but scanty in old caseous foci and the chronic disease of the joints and lymphatic system. They may be present in the blood, especially in cases of miliary tuberculosis. In the sputum of pulmonary tuberculosis they may be found sometimes in enormous quantities, sometimes only in scanty numbers after prolonged search. Variations in the number, under ordinary circumstances cannot be regarded as indicative of the result of treatment or as of prognostic value; though their complete absence, coupled with improvement in the general condition of the patient, may, after a prolonged period, be viewed as favorable.

There are special differences between the bacillus which causes bovine tuberculosis and that giving rise to tuberculosis in the human being, as there are well-recognized differences in the tubercles; but it is now generally

admitted that the bovine bacillus may produce a special form of the disease in human beings, particularly in children.

The existence of tubercle bacilli outside the body, is primarily due to its presence in the sputum of patients suffering from advanced pulmonary tuberculosis, and in the milk of tuberculous cows. The human organisms are thus distributed, not only upon the persons and immediate surroundings of the patient, but also in the dwelling in which he lives, the places which he visits, along the streets which he traverses, and in the conveyances in which he journeys from point to point. Adhering to the particles of dried sputum, which form part of the atmospheric dust, they are carried to considerable distances, and effect lodgment upon the mucous membranes of the upper respiratory passages from the inspired air. Their presence can be demonstrated, experimentally, in samples of dust collected in the most varied localities in cities. Wherever there is a crowd there are tuberculous persons, and wherever a consumptive spits, tubercle bacilli are scattered. It is of the highest importance in this connection to note that, where the use of the spit cup has become a habit, and the destruction of the sputum by fire, boiling or chemical means is vigorously carried out, as in sanatoria, samples of dust from the living rooms and wards may fail to show the presence of tubercle bacilli.

The bacilli of bovine tuberculosis are distributed by the milk, which is a frequent cause of intestinal and other forms of tuberculosis in children, especially in cities. The pasteurization employed by the dealers for commercial purposes does not destroy tubercle bacilli. The flesh of tuberculous animals is an undesirable food, but, when thoroughly cooked, it is not likely to cause tuberculosis.

Domestic animals other than horned cattle show varying degrees of susceptibility. The liability of the hog is much less than that of milch kine; of sheep and the horse very slight; of the dog and cat still less, although these animals, housed as pets with tuberculous persons, occasionally contract the disease.

Wild animals in their native habitat do not suffer from tuberculosis, but in captivity they are very liable to the infection. Among laboratory animals, rabbits and guinea-pigs are particularly susceptible, and have been much used in research work. Avian tuberculosis constitutes an especial variety of the disease.

The Transmission.—That the consumptive frequently communicated his disease to others in association with him was known to the ancients. Hippocrates described the clinical manifestation of tuberculosis of the lungs, and Galen pointed out its contagiousness. This knowledge long led to no general practical results. It was, however, early recognized in Italy where the patients were segregated in lazar-houses. But not until later, in the nineteenth century, was the contagious nature of tuberculosis, through the work of Villemin and Koch, placed upon a scientific basis, and a reasonable prophylaxis made possible. So widespread among the races of men in all parts of the world is tuberculosis infection, and so overwhelmingly

abundant is the field of pathogenic organisms from the ulcerating and necrotic lesions that, were it not for two things conspicuous in the natural history of the disease, mankind would long since have perished from the face of the earth—*dead of consumption*. These saving factors are first, the impermanence of the bacilli outside the body, and second the very general, natural or acquired immunity of human beings.

Tubercle bacilli from lupus or other superficial lesions, from the mucosa of the upper air passages or the mouth, from sinuses discharging broken-down tissue from lymph-nodes, tuberculosis of bones or joints, from the intestinal or genito-urinary tracts play a minor part in the great tragedy. They are too few in number and for the most part they leave the body of the patient under conditions unfavorable for their ready transmission to others. It is the abundant sputum of advanced pulmonary tuberculosis, loaded with recent, luxuriantly grown, actively pathogenic bacilli, that is the real agent by which the prevalence of the disease is maintained, and extended. It is against this agent that prophylaxis, both general and individual, must be directed. Stated in these terms, the problem of prevention seems a very simple one. The actual difficulty lies in the vastness of the undertaking. It is a matter of education. Ignorance is more prevalent than tuberculosis. The first lesson is the immediate, effectual care of the sputum and the destruction of the bacilli which it contains. Immediate, because it is in the recently expectorated bacilli that the greatest danger of infection lies. Finding a proper soil they are ready to take root and grow. Failing in that, an enormous proportion of them perish. The favorable soil is the tissues of non-immune human beings; the mode of access by droplet infection, in coughing or sneezing, by ordinary conversation, the use of a handkerchief, a contaminated cup or table utensils, kissing, innumerable ways of approach or contact. Lesions of the skin, as in circumcision, when the operator is tuberculous and hemorrhage is arrested or the wound cleansed by suction; the bite of a tuberculous person, the scratch of a broken spit cup may serve as the portal of infection. The assertion that vaccination may be the means of the transference of tuberculosis lacks the support of evidence. As the virus for antivariolous vaccination is now prepared, the communication of pulmonary tuberculosis can scarcely occur. A few cases of lupus originating at the point of vaccination have been reported in the older literature. In point of fact, the danger of the transmission of tuberculosis by skin inoculation is not great, the lesion being, as a rule, insignificant and remaining localized.

The destruction of the bacilli-containing sputum must not only be immediate; it must also be complete in order to be effectual. The proper care of the spit cup and its contents is not sufficient. The lips, the hands, the clothing and immediate surroundings of the patient must be equally cared for. He must be taught, and the attendants must know, that only by the most constant vigilance and scrupulous cleanliness can he be prevented from becoming a focus of infection. The powdered, dried sputum about the patient and in his room and house, and his accustomed haunts, is

the dust to be dreaded. Beyond these limits the danger radially, and perhaps rapidly, diminishes. The virulence of individual strains of tubercle bacilli, as of other specific infections, varies. The virulence of particular groups of bacilli must undergo, as they recede from their source of origin and fail of implantation in a favorable soil, a gradual diminution under natural causes and ultimate destruction. The conditions which tend to this result are incident to the lapse of time and a progressively more unfavorable habitat. Desiccation, the destiny of dust in the economy of nature, exposure to fresh air and sunlight, play their part. This time-honored phrase has in our day assumed a new significance in the prophylaxis and treatment of disease. Fresh air now means, among other important attributes, oxidation and dispersion; sunlight has given to medicine a new art in healing; heliotherapy is very potent in the treatment of patients suffering from tuberculosis of bone, joint, gland and the serous membranes, and if capable of acting upon tubercle bacilli in these situations, probably also destructive to them in the atmospheric dust. It would appear that too much importance has been attributed to tubercle bacilli in out of the way places. In the scrapings of walls may lurk organisms of attenuated virulence that are capable of producing fatal tuberculosis when experimentally introduced into highly susceptible guinea-pigs, but harmless to more or less immune human beings when inspired or swallowed. In fact, the experimental researches of Flüge and others fail to confirm some of the earlier deductions of Cornet. Intimate association, such as occurs in asylums, reformatories, workhouses, homes for feeble-minded or aged persons, cloisters, prisons and other institutions in which the residents are usually crowded together and deprived of sufficient opportunities for open air exercise, greatly increases the danger of infection. The statistics of all such places show a death-rate much above that of the surrounding region and largely due to tuberculosis. The well-known studies of Flick show tuberculosis to be a house infection. But the houses in which cases occur in series of tenant families are ill-lighted, badly ventilated, unclean and unsanitary in other respects, and the occupants mostly grossly ignorant and indifferent to the conditions in which they live. Furthermore, such houses are usually in demand on account of low rentals, and their infection is continuous and constantly renewed. Scrubbing, the whitewash brush, systematic cleanliness, sunlight and ventilation are too often unknown. In houses where these agencies are active, and in institutions properly organized and efficiently managed, house infection from tuberculosis may be prevented. But even under these circumstances, in the absence of extreme care on the part of the patient suffering from advanced lung tuberculosis, his immediate surroundings as well as he himself may disperse a constantly renewed infection.

Immunity against tuberculosis is very general. Its practical consideration is of the highest importance in preventive medicine, but there are important questions as yet unsolved. Bound up as it is with the subject of predisposition, it presents many points of great interest to the student. The general proposition that those who come into close association with

consumptives are in danger of contracting the disease holds good; but it is not of general application. The majority do not; they are immune. Whether this immunity is in any particular instance natural or acquired, cannot be determined. Aboriginal races, as the North American Indians, South Sea Islanders, and Esquimaux, among whom tuberculosis was unknown until introduced by explorers and the early settlers, suffered greatly, a fact suggesting an absence of natural immunity. On the other hand, the great majority of all individuals are infected in early life, many of them without manifesting, at the time or subsequently, any evidence of tuberculosis. They become tuberculous but not consumptive. It has been estimated that in large cities in fully 90 per cent. of the bodies of persons coming to autopsy, who have died of other diseases than tuberculosis, small, obsolescent tuberculous lesions are found. A positive reaction to tuberculin tests has been observed in 90 per cent. of children, under twelve years of age, examined. These facts indicate a very wide-spread natural immunity. Local tuberculosis, following a contusion in a person manifesting no symptoms of tuberculous disease, may be explained by the presence of bacilli in the injured part, previously quiescent, but undergoing active growth in response to lowered powers of resistance in the affected tissues. This contusion tuberculosis is not infrequent in the joints, especially the knee, and may occur as meningitis after a blow upon the head, or take the form of a rapidly developing pulmonary tuberculosis after a severe injury to the chest. It would thus appear that the tissues of the adult human being in normal health do not constitute a favorable soil for the growth of the tubercle bacillus. It may also be inferred that repeated reinfections with small quantities of bacilli, not in themselves capable of causing the disease tuberculosis, may increase the immunity in individuals in whom there is not an especial local or general predisposition.

Acquired immunity may result from a local tuberculosis that has terminated in prolonged obsolescence or recovery. This condition is seen in the healed local lesions in the lungs of persons dying from other causes and manifesting, upon autopsy, no evidence of tubercle elsewhere. It occurs also in joint tuberculosis. Individuals who have recovered from tuberculosis of the vertebræ, hip joint or knee, frequently have excellent general health for a long period of time. They often, however, ultimately develop active pulmonary tuberculosis from fresh infection, the immunity having expired, or from the migration of bacilli from a long quiescent focus.

The Predisposition.—The phthinoid and pterygoid chest is not only seen in phthisical individuals, but it is also characteristic of those who manifest a peculiar susceptibility to phthisis. On the other hand, a large proportion of those who contract the disease have well-developed chests and primarily present every appearance of normal health. The general recognition of tuberculosis as an infection to which the liability is widespread has detracted somewhat from the importance formerly attributed to so-called diathetic states. Nevertheless, a hereditary predisposition is clearly apparent in families. The disposition is, however, generally acquired.

(See also Vol. II, pp. 181-2). Any condition of living which impairs the powers of resistance of the body to morbid agencies constitutes a predisposition. The list is a long one, and, in addition to an organization congenitally delicate and an unfavorable environment, comprises developmental, nutritional, occupational, infectious, most chronic and some acute diseases of the nervous system, diseases of the respiratory organs, many visceral diseases, chronic intoxications, especially alcoholism, diathetic maladies and the degenerations of advancing age. Tuberculous infection, often a complication of previous disease, not rarely assumes the leading part, and the terminal event is frequently an acute tuberculosis. In infancy and childhood, measles and pertussis are very often followed by rapidly fatal tuberculous disease, which may be the result of fresh infection or the lighting up of previously latent infection. Later in life, cirrhosis of the liver and diabetes are especially liable to terminate in *phthisis pulmonalis*.

THE PREVENTION.—It has been estimated that one-seventh of all deaths are caused by tuberculosis. More conservative recent estimates indicate that about one-thirteenth of the total death-rate of the world may be ascribed to this disease. The English statistics show in the period of forty years between 1871 and 1910 a reduction in the mortality from pulmonary consumption of nearly 50 per cent. In the United States similar reductions have been noted. These declines in the death-rate, which have been observed in varying degrees in all parts of the civilized world, cannot be wholly attributed to the crusade against tuberculosis. This great movement started about the beginning of the present century; but the falling death rate from tuberculosis dates from the development of modern sanitary science, which had its origin in bacteriology, and the study of causes in the last quarter of the nineteenth century. It was due to improved conditions of living and the realization of the importance of personal and public hygiene. With better housing, better food, less drunkenness, the reporting of cases of contagious diseases and an intelligent and effective home and ship quarantine, there was a general improvement in the public health and a remarkable decline in the mortality from epidemic and other diseases, particularly in tuberculosis. In the same period, the momentous work of Trudeau in the care of patients and laboratory investigation attracted wide attention. During this period sanatoria for tuberculous cases were established in all parts of the world; and the opportunities for the clinical and laboratory study of the disease which they afforded, yielded results of the greatest importance in correcting traditional errors in regard to the treatment of cases, and the value of drugs, and in placing the management of patients suffering from tuberculosis upon a scientific basis. Not only were the people educated, but the physicians were also aroused from their lethargy in regard to tuberculosis. The patients came under observation earlier and received proper attention. Spitting in public was discountenanced and forbidden by law.

In 1905 the National Tuberculosis Association began its active labors in the United States. As the result of its work in organization during the

sixteen years to the present time, there are now tuberculosis associations in every state and more than 1,100 local associations in the large centres of population. Through these bodies nearly 700 sanatoriums and hospitals, 550 dispensaries and clinics, 1,000 open air schools and many other agencies for the diffusion of knowledge concerning tuberculosis and the care of the patients have been established. It has carried its propaganda to the most remote districts in every part of the country and successfully sought, by all available means, to arouse the interest of the people. It has secured a place in the exercises of the public schools for the teaching of health habits. For this purpose and in order to bring suspected cases to the attention of the medical inspectors, and for other services in regard to its general work, it has in its employ, or has obtained the appointment of, a great number of especially trained nurses for tuberculous cases. The National Tuberculosis Association has, in many other ways, exerted a powerful influence in the crusade against the disease, especially in securing favorable legislation, stimulating research and arousing interest in all efforts to improve the public health. During the period of fourteen years from 1905 to 1919, the death rate of tuberculosis in all its forms, in the registration area of the United States, fell from 193.6 per hundred thousand of population to 125.6, a decline of 35 per cent. In Framingham, Mass., where this organization has carried on an intensive effort, the mortality has fallen almost 50 per cent. in the last four years. These figures, making due allowance for errors in statistics of this kind, are most instructive. In large groups of persons, where intensive antituberculosis work has been systematically carried on, and the results accurately determined, very favorable results have also been obtained. Among the industrial policy holders of the Metropolitan Life Insurance Company, the death rate from tuberculosis has fallen in the last ten years from 224.6 to 135.0 per hundred thousand, a decline of 40 per cent.

The main points of general prophylaxis are:

(a). The education of the public as to the nature, cause and transmission of tuberculosis, the part played by the sputum, and the necessity for its immediate and continuous, effectual destruction by burning or boiling. In hospitals and sanatoria, printed directions should be placed in conspicuous positions and cards, giving and explaining the important rules, given to the dispensary patients. Patients should be informed of the nature of the trouble while it is in its early stages, and made to understand that, under proper treatment, in the majority of cases there is a reasonable hope of the arrest of the disease. The danger of spitting anywhere, except into a spit cup or into paper handkerchiefs, to be immediately placed in a proper receptacle and burned, must be emphasized to the patient, and the necessity of scrupulous cleanliness of his person, clothing and surroundings for the safety of others made clear to him. Armstrong and Bartlett¹ in an enlightening communication on the intensive study of tuberculosis at Framingham made the following statement:

¹Jour. A. M. A. Aug. 20, 1921.

"The chief factors that seem to be responsible for the late discovery of tuberculosis cases, which give to the community every year advanced and dying patients that have not been known or treated for tuberculosis in the early stages of the disease are: the recluse type, which seems to be the main type, never receiving any medical attention; failure of patients to seek medical advice early, or, if they do, not to give the physician sufficient time to make a diagnosis; occasional failure of physicians to detect disease early; failure of both physician and patient to use all of the services at their command for early diagnosis of tuberculous disease; lack of complete annual medical examination and lack of annual factory and school examinations."

(b). The education of the practitioner is no less important than that of the people. Upon him devolves the duty of early diagnosis, and the prompt institution of systematic treatment appropriate to the individual case. The day when he could temporize and talk about *bronchial catarrh* and a *spot on the lung* has passed. The responsibility which rests upon him is immediate and urgent. If the patient be ignorant and poor, so much the more important that he be guided in the right way—to the local dispensary or the special hospital as the case may require. If he be intelligent and well to do, he stands equally in need of clear, explicit and sound advice. In either case the physician must know what to do, and to have this knowledge he should take an active part in the local and national antituberculosis organization. Trudeau societies are being organized in many parts of the United States and are very helpful to physicians and workers in the antituberculosis crusade. Among the conditions necessary for membership are experience in the diagnosis and treatment of tuberculosis, some knowledge of research, and special interest in the problem of eradication.

(c). The education of the nurse in regard to tuberculosis is no less of importance. She must know how to take care of her patient, but she must also know how to take care of herself. Many lives have been thrown away for the want of this knowledge. A clear understanding of the nature of the disease and the mode of infection, and a lively appreciation of the danger of her work, constitute her greatest safeguards, unless she happens also to be one of the immune.

(d). The education of the public authorities is a never-ending function of the medical profession, as an organization, and of the antituberculous societies. The enactment and enforcement of laws against spitting in public places, for the reporting of communicable diseases, for the disinfection and cleansing of rooms and houses which have been occupied by patients suffering from tuberculosis, and the rigorous inspection of slaughter houses and dairies, are among the essential matters of public business. The legal control and regulation of factories, refineries, foundries and other places in which many working people are employed, is likewise a paramount duty of the State. Not less important is the appropriation of public moneys for the establishment and maintenance of proper hospitals, sanitoriums and dispensaries. In the center of population there should be, in suitable suburban localities, and some distance apart from each other, hospitals of two

kinds for the care of consumptives. First, to meet the requirements, in the early stages of the disease, of wage workers, whose condition temporarily prevents them from earning a living, and who, in addition to suitable treatment, may be taught how to take care of themselves, and the means by which they may minimize the risk of communicating the infection to others; and second, for the reception of advanced and hopeless cases as a matter of public safety. In connection with such institutions, there should be a well-organized department of social service in order that patients leaving the first, convalescent or from any other cause, may be kept under continuous observation; and for the purpose of doing what may be required for the welfare of the family or associates, from among whom the advanced cases have been removed to the second.

Highly important also, from the standpoint of prophylaxis, is the determination by the State of the presence of tuberculosis in cattle by the injection of tuberculin.

Two centuries ago typhus was the scourge of the world; a century and a half ago, small-pox; a century ago, scurvy; for many decades, typhoid fever. These calamitous diseases one after another have ceased to prevail, and they now occur only in circumscribed outbreaks in districts where the principles of preventive medicine are unknown or ignored. Tuberculosis has been, throughout the ages, the despair of mankind. To-day, in the knowledge of the impermanence and modes of transmission of its cause, there is the reasonable hope that its widespread prevalence will also be brought to an end.

Individual Prophylaxis:—Many of the important points have been considered in the foregoing section in general prophylaxis. The route by which tubercle bacilli reach the lungs and cause the most common and formidable type of the disease, pulmonary tuberculosis, has long been the subject of special investigation, alike from the standpoint of the clinician and that of the worker in laboratory research. The following modes of access have been considered:—

(a) **CONGENITAL INFECTION.**—Bacilli reach the ovum from tuberculous semen or the foetus becomes infected by bacilli which have passed by way of the placental vessels from a tuberculous mother. The conclusion warranted is that this form of direct inheritance is extremely infrequent, and of such subordinate importance to extrauterine infection that it may be disregarded in prophylaxis. Tuberculosis in young infants is almost always due to post-natal infection from close association with a tuberculous mother or nurse, or milk from tuberculous cows. Persons suffering from active pulmonary tuberculosis ought not to marry. Arrested cases in which the general health appears good, and for two or three years tubercle bacilli have not been found in the sputum, may marry with no great risk, especially when the patient is in good circumstances. Pregnancy, parturition and lactation may be followed by the lighting up of quiescent lesions and a return of the symptoms of active disease. Persons of either sex in whom symptoms continue, and bacilli are present in the sputum, incur great risks.

The danger of infection by ordinary intimate association, when either wife or husband is free from the disease, cannot be disregarded. The question of marriage is unfortunately very rarely decided upon medical opinion.

(b) INOCULATION INFECTION.—Bacilli gain access to the interior of the body by way of a lesion in the skin, or an accessible mucous membrane, and are carried by the lymph stream or the blood current to the lung. The danger of lung infection from a lesion of the skin is not very great. Post-mortem warts, such as occur to those who conduct autopsies, and slight wounds, incurred in anatomical dissections, by laundry women who wash the clothing of tuberculous patients, or by butchers, are not often followed by pulmonary tuberculosis. Infection by way of the urogenital mucosa is of infrequent occurrence. Injury to the protecting epithelium of the mucous membrane of the mouth and upper respiratory passages, such as occurs in the catarrhal affections of young children, is attended by the danger of the direct lymph or blood-borne transmission of bacilli to the lung. Infrequent as this form of infection appears to be, it may be an important matter in prophylaxis and constitutes a clear indication for the proper treatment of the parts involved and the sedulous protection of the patient from exposure to tuberculous infection.

(c) INGESTION OR DEGLUTITION INFECTION.—Bacilli present in the food, mucus, saliva or the products of inflammatory or other morbid processes in the mouth, pharynx or upper air passages are swallowed with the food, and passing through the pylorus cause primary intestinal tuberculosis; or, as is more commonly the case, penetrate the intestinal mucosa and reaching the mesenteric lymph glands are carried thence by way of the thoracic duct and the blood stream to the lungs.

(d) DIRECT LYMPHATIC INFECTION.—Bacilli find their way to the mucous membrane of the nose, mouth or pharynx in the inspired atmospheric dust or in minute droplets of the moisture ejected by the patient, in coughing or sneezing or even in ordinary conversation. From these situations they pass to the regional lymph-nodes of the neck and are thence ultimately transported to the lungs by way of the blood.

(e) INHALATION INFECTION.—The bacilli pass into the bronchi and alveoli and then give rise to the primary lesions of the tuberculous process, or they penetrate the bronchial mucosa and become lodged in the tracheo-bronchial glands, being thence disseminated by way of the circulating lymph and blood to the lung. Each of the last three methods of infection has its strenuous advocates among investigators. The older view is that which favors inhalation infection; the more recent opinion, that which endorses the theory of infection by deglutition. The decision has not been reached, but the probability remains that all three pathways lead to the lung; none, however, to the exclusion of the others. The general opinion that tuberculosis is primarily a disease of lymphatic tissue, in which the bacilli lodge and multiply and from whence they are in the great majority of instances borne to the lung, is not in conflict with the view that it is in the main an inhalation disease. This view is supported by the following

facts: The great dissemination of bacilli-laden sputum in consequence of the wide endemic prevalence of consumption; the lymph structures are the gateways through which the bacilli pass into the blood; the lungs are the most obnoxious of all organs to the infection and, as a rule, the first to manifest its anatomical lesions. The various avenues of infection should be guarded with equal care. The essential consideration is to use every available means to prevent the access of the infecting organism at any portal. The measures consist in the proper care of the sputum and great watchfulness in intercourse with patients to avoid the immediate or mediate transference of fluids of any kind, which may be bacilli-laden, to those around them. Flies, attracted by sputum or other discharges not immediately disposed of, may deposit the bacilli upon food or table utensils. Tubercle bacilli have frequently been demonstrated upon the legs of these insects, captured after contact with tuberculous sputum. Equally important is the maintenance of sound health. Delicate children and those born of tuberculous parents, or in families in which there have been cases, should be nurtured under the most favorable hygienic conditions. They should be guarded against respiratory affections of every kind with especial care, and apparently trifling evidences of catarrhal disorders of the nose, throat or bronchi should receive immediate attention. Mouth breathing, enlarged tonsils, adenoid vegetations, sniffing and signs of nasal obstruction require proper treatment without delay. Even slight lesions of the nose and throat may open the way for tuberculosis. Kissing on the mouth should be forbidden. In this connection it must be remembered that there are carriers of tubercle bacilli, just as there are carriers of diphtheria bacilli, and much in the same way. Usually these carriers have no symptoms, except some habitual cough and expectoration, chiefly in the morning hours, and the examination of the latter as a matter of routine reveals the presence of the organisms. Delicate children must be shielded from association with persons who, at the time, have an occasional cough; and in particular, at all times from association with any person who has a chronic cough. Such children should be brought up in the country, rather than in a city, and if practicable, in a climate which permits an open air life at all seasons of the year. The clothing must be warm but light; long hours of sleep, a well-ventilated room, and a separate bed for every child should be the rule. The daily bath, followed by brisk friction of the whole body is important. The diet must be simple, substantial and wholesome. Milk should be a staple article of food. It is a curious fact that persons who most need fats frequently have little appetite for them; but all children like the milk fats, cream on their oatmeal and butter on their bread. Fruits and fruit juices are desirable, and children should early acquire the habit of eating the leaf vegetables cooked or in the form of salads, since these contain mineral salts, which are as essential to a normal diet as carbohydrates, fats and proteins. Such a life, in which the rules of hygiene are habitually observed, varied to meet changing conditions, as childhood passes into adolescence, is the best safeguard against the influences which predispose to tuberculosis, the

surest way to gain and keep that health which enables the body to withstand the invasion of the infecting principle of the disease.

The choice of an occupation must be carefully considered. Those callings in which much time is spent in the open air are most favorable; but when they demand very hard labor or continuous exposure to damp or the vicissitudes of the weather, the risk is great. Dusty occupations, as milling, baking, knife-grinding, stone-cutting, mining, the handling of coal and grain, are unsuitable for those predisposed to tuberculosis. Sedentary employment, provided that the surroundings are favorable as to ventilation, lighting and cleanliness,¹ and there is opportunity for some part of the day in the open air, are not unsuitable for delicate persons, who have a disposition to tuberculous disease. Occupations which involve close association with great numbers of fellow workmen are attended with danger to those who are predisposed to tuberculosis.

The subject of immunity against tuberculosis, despite the great amount of labor expended upon it in the last two decades, is still a matter of controversy. The confusion is, in part, due to the failure to recognize the fact that the term "tubercle" is applied to the tissue reaction to the implantation of the infecting organism, and the designation "tuberculosis" to the disease or group of diseases resulting from the growth and multiplication of the bacilli, their production of other tubercle in adjacent tissues or remote structures, and the consequent derangement of normal physiological functions. Bacteriology has sought, in vain, the part played in immunity by the serum content of antitoxins, bacteriolysins and complement fixation principles, tissue reactions, proteolytic and lipolytic ferments, mechanical factors relating to the tubercle and many other things. Attempts to produce general immunity by the injection of dead or avirulent bacilli have failed. The employment of living bacilli has caused, at best, a transient relative immunity, and failure has followed the use of various derivatives of tubercle bacilli, and sera from animals that are immune to tuberculosis. It remains that infection with tubercle bacilli causes, in some human beings, no symptoms whatever, the organisms remaining quiescent in the tissues for an indefinite period, not even causing tubercle, so far as is known, until lowered health or traumatism or acute or chronic disease activates them, and tuberculosis results. As a rule, this prolonged inactivity is probably passed in lymph structures, and certainly sometimes in lymph-nodes. Very commonly a local pulmonary tuberculosis results without impairment of health, with little disposition to spread, and only found, post-mortem, years afterward as an encapsulated or cretaceous vestigium. These cases the clinician looks upon as manifestations of immunity, and supports this view by many other facts. Among these are the following: The wide-spread distribution of innumerable bacilli continuously, by persons suffering from pulmonary tuberculosis in its late stages, but fortunately communicating the disease to only a relatively small number of those with whom they come into association; the great prevalence and high death rate in institutional tuberculosis, but which wholly spares a considerable proportion of inmates;

and the escape in every community, no matter how prevalent the cases of tuberculosis may be, of a majority of the inhabitants, those contracting the disease being referable to several fairly well-defined groups. These are: (1) Mild infections with slight symptoms, recovering in the course of a few months of treatment. (2) Cases with the evidences of lung disease well marked, in which permanent arrest of the process takes place after thorough treatment at home or in a sanatorium. (3) Cases with extensive lesions and cavity formation, in which the progress of the disease may be held in check, and a life of invalidism prolonged for years. (4) Cases which run a rapid course to a fatal termination despite treatment. (5) Cases of fibroid phthisis, a well-characterized tuberculous condition, essentially chronic, which may last several years, with a moderate degree of health. (6) A considerable number of cases of slight infection, in which recovery takes place without the patient having any knowledge of the nature of a trifling illness, through which he has passed without treatment. These facts not only establish the immunity of human beings to tuberculous infection, but show an immunity almost as varying in degree as that among animals, from the highly refractory horse to the intensely susceptible guinea-pig.

Among measures of personal prophylaxis, which in recent years have attracted general attention, is the establishment in various places of institutions called "Preventoria." They are of the nature of sanatoria to which persons in poor health, without well-defined manifestations of any substantive disease, members of families in which tuberculosis has occurred, and others supposed to be in the so-called pretuberculous stage may be placed for medical supervision and treatment. The children of tuberculous parents are cared for in special institutions. The means employed comprise an open-air life, an abundant, well-balanced nutritious diet, long hours of sleep, due attention to bathing, clothing and exercise, a strict but not wearisome routine, and the individualizing of each patient. The results have been very satisfactory and courses of eight or ten weeks, repeated from time to time, are credited in many instances with a restoration to normal health. Apart from all personal considerations, the importance of individual prophylaxis can scarcely be overstated. A single predisposed human being at any age, who can be saved from infection or can be rendered immune, may mean one less focus of infection at a later period.

Professor Much of Hamburg, whose recent work in the subject has attracted widespread attention in Europe, holds that there occur natural transitions between the human and bovine forms of tubercle bacilli, and that these organisms are not to be considered as members of different families, but only as different forms of the same family. He also regards tuberculosis as essentially a disease of childhood, an opinion sustained by various biological reactions and generally accepted at the present time. The child, during the first year or two of its life, does not react to specific tests, but becomes infected from its parents or tubercular surroundings. The portal of infection is of less importance than hitherto thought, since in

one way or another, most individuals become infected early in life and of these, only a small proportion by means of cow's milk. The spontaneous healing of this early infection causes an immunity which is more or less lasting, but is increased by subsequent infections from time to time. This immunity is due to the presence of antibodies, which are active not only against the existing infection, but also against new infection from outside sources; when, however, these antibodies are diminished by disease, especially measles, pertussis or influenza, or the new infection is massive, the immunity is overcome and a relapse of the disease occurs. The diagnosis is made by a most careful anamnesis, physical methods and röntgenographic studies. The tracheobronchial glands are, in the great majority of cases, first involved. Lesions at the apex are not common in infancy. The treatment by the method of this observer, when properly carried out, is said to be very successful. In addition to the usual prophylaxis and hygienic and symptomatic medicinal means, it consists of specific measures to increase immunity by the hypodermic injection of the author's partial antigens or "partigens" in courses of several weeks, at intervals of some days. These substances are prepared from tubercle bacilli, and represent: first, the fat-acid-lipoids, which are soluble in alcohol, called *F*; second, the natural fats, high molecular fats or wax alcohol, soluble in ether, called *H*; and third, an entirely nonsoluble residuum, a high molecular albuminous substance, which contains a large amount of phosphorus and belongs most probably to the group of nucleo-proteids and is called *A*.

Together with this, the X-rays are employed.¹

Expectant-Symptomatic Treatment.

Tubercle bacilli are variously distributed throughout the tissues and organs of the body. Many that lodge upon the intact mucous membrane of the upper air-passages are presently swept away without producing any effect; of the few that enter the skin by slight abrasions, some produce local tubercles which, though slow to heal, are non-infective; those that penetrate the outer defenses of the body are arrested in the lymph-glands that drain the region of entrance, where they may remain inactive or cause local tuberculosis, or whence they may be carried to the lungs or other organs. In childhood the lymph-glands, bones and joints are especially prone to the infection; in adult life, the lungs. No satisfactory explanation of the primary localization of the tuberculous process in the various organs of the body has been adduced. The first anatomical lesion is the formation of tubercle in some of the cells of which bacilli are present. These organisms multiply, and invade the surrounding tissues by direct extension or by way of the lymph currents. Clusters of tubercles are those formed. It is probable also that an abundant invasion may establish multiple clusters at or about

¹Consult "Tuberculosis of Children: Its Diagnosis and Treatment." By Professor Dr. Hans Much, Director of the Department for the Science of Immunity, and for Research of Tuberculosis at the University at Hamburg, Germany. Translation of Dr. Max Rothschild, Medical Director of the California Sanatorium for the Treatment of Tuberculosis, San Francisco and Belmont, Cal. Macmillan Company, New York, 1921.

the same time. The tubercle undergoes degeneration through a process of coagulation necrosis, which takes place in the cells, and the gradual formation of a structureless grayish body in which bacilli are present. There is an absence of blood vessels. The coalescence of these bodies forms nodules, which may undergo caseation and softening, or fibrosis and calcification. In the lungs, this process begins, commonly, just below one of apices, most frequently on the right side, and advances downward, the infecting bacilli being carried by way of the bronchi, the lymph or the blood. Extension to the opposite side is mostly by way of the bronchi. There is sometimes associated with these nodules an extensive bacillary pneumonia, or a diffuse infiltration with caseation may occur in the absence of tuberculous foci. The histological processes in any particular case are determined by the powers of the tissues to withstand the destructive action of the infecting organisms. The invading bacilli are doubtless in some cases promptly destroyed; more commonly they effect a lodgment; give rise to tubercle formation and, after a more or less prolonged struggle, they are overcome by the protecting processes of encapsulation and sclerosis, and recovery occurs. In other cases they find a tissue soil that is favorable, grow and multiply luxuriantly, causing rapidly extending caseation and softening, cavity formation, and the invasion of other organs. In the first of these conditions there is a trifling lesion of the lung without systemic disease; in the second group, a more or less severe constitutional disease with well-marked pulmonary lesions; in the third, an overwhelming infection with extensive tissue implication, not only of the lungs but also of the pleura and distant organs, especially the larynx and intestines, and a fatal ending. In the lung the pathological process is present in all stages of development, and for this reason the clinical manifestations are of the most varied description.

These facts have an obvious bearing upon the general management and treatment of individual cases.

The Expectant Treatment.

A very large proportion of those infected never have tuberculosis. How large this contingent is cannot be known, since many of them are not even ill, and many others suffer merely a transient and trifling indisposition. The diagnosis is made after death from some other cause, and rests upon the presence of the circumscribed, obsolescent lesions in otherwise healthy lungs. They are instances of natural or spontaneous healing.

The Treatment Of Symptoms.—It is in accordance with the general plan of this book to take up the consideration of the treatment of symptoms before entering upon the study of those measures which act, directly or indirectly, upon the cause of the disease. By the amelioration of the annoying or distressing symptoms of disease, the patient is placed in a better condition to carry out measures directed against its cause. Hence symptomatic treatment in most cases of tuberculosis is frequently desirable, often indispensable.

Cough.—This symptom is one of the first to appear, and in cases that recover, the last to disappear. As an early symptom, it is, not rarely, noticed by his associates before it attracts the attention of the patient himself. It is then common on rising in the morning, continuing usually until a small mass of mucus is dislodged and expectorated, and being less troublesome or absent altogether during the day. It varies under different circumstances, and from time to time during the progress of the disease, being dry or loose, hard or soft, more or less continuous, steady or paroxysmal. When caused by the presence of mucus or pus, less frequently blood in the bronchi, trachea or larynx, it is a natural effort to dislodge the irritating substance and is therefore beneficial. Less commonly, the irritation of the cough reflex arises in pleural inflammation, congestion or enlargement of lymph nodes at the tracheal bifurcation or elsewhere in the mediastinum; and the cough is not only unproductive, but also tends to increase the irritation which caused it. In either case it tends, in neurotic patients, to become psychic and develop into a habit. It is obvious that the treatment of cough in tuberculosis must be adjusted not merely to the symptom, but rather to its cause.

Cough that is occasional and relieved by expectoration should be let alone. In severe or continuous paroxysms of this form, relief may follow a glass of water or warm milk slowly sipped; or bits of ice allowed to dissolve in the throat or various sedative lozenges containing menthol, glycerine, slippery elm or cubebs. Spraying the throat with Dobell's solution, or with oil containing eucalyptol, camphor, chloretone or chloroform is of service in allaying laryngeal irritation and stimulating the secretion of mucus, by which offending particles of tenacious sputum may be dislodged.

Cough due to pleural congestion or inflammation or glandular irritation may be relieved by bits of ice dissolved in the throat; the application of an ice bag or sinapisms over the *manubrium sterni* or, these failing, by the administration of sedatives such as morphine, codeine, heroin and dionin in small doses and preferably in solution in essence of pepsin or some other vehicle not likely to derange the stomach. Where such remedies are necessary, due regard must be given to their habit-forming dangers, particularly in a chronic disease. This risk may, however, be disregarded in the *stadium ultimum* of pulmonary consumption. Dilute hydrocyanic acid, chloroform and preparations of thymol are of inferior value.

Psychic cough and the cough habit may be successfully treated by suggestion, and teaching the habit of self-control. The comparative infrequency of cough among the patients in sanatoria may be ascribed to their having learned to avoid coughing until sufficient secretion has accumulated to enable them to expectorate readily.

Patients should avoid smoke, dust and irritating fumes of every kind. Tobacco smoking, loud talking and physical effort of any description which brings on cough should be interdicted. A distressing and persistent cough in advanced cases is frequently caused by laryngeal erosions.

The most important indication in any form of tuberculous laryngitis is rest. In the milder cases the patient may be permitted occasionally to

use the whispered voice; but in the severer forms the use of the voice should be altogether forbidden. If there is irritating laryngeal cough, the patient should be put to bed, if that form of treatment has not already been instituted, and some form of opium or other suitable sedative administered. For a time, at least, under this treatment, congestion and swelling are reduced, superficial erosions show a tendency to heal, and the aphonia disappears. In the cases attended by ulceration, local cleansing followed by suitable medicated applications may be followed by relief; but these measures can only be carried out under anæsthesia of the larynx and surrounding tissues by eucaïne or some similar agent, in patients who tolerate the necessary manipulation and by a physician skilled in the technic of laryngoscopy. Otherwise, attempts at local treatment are liable to increase the sufferings of the patient and make a bad matter worse.

Cases have been reported in which cough has been so prolonged and severe that recourse to artificial pneumothorax has been necessary for its relief—a procedure justifiable only in the presence of other clear indications for its performance.

Expectoration.—This symptom, as a rule, does not require special treatment. The accumulation of the night, which is voided by the paroxysmal morning cough on rising, is in many cases all that comes up in the course of twenty-four hours. If gagging and nausea accompany the effort, the patient should have a glass of warm milk before rising. Ammonium chloride is useful when the expectoration is thick and tenacious; when it is excessive, creosote or guaiacol, best borne in some of the proprietary forms, may be administered. In cases where vomica exist, the expectoration of the accumulated fluid may be facilitated by postural changes on the part of the patient. Among the favorable conditions following artificial pneumothorax is a remarkable diminution in the amount of the sputum.

Blood-spitting; Hæmoptysis; Broncho-Pulmonary Hemorrhage:—This accident occurs at some time during the course of the disease in about 75 per cent. of all cases of pulmonary consumption. Not infrequently it is an early symptom. It may occur suddenly in young persons, apparently in good health in the absence of over-exertion or injury; physical signs are negative and tubercle bacilli are not found in the sputum. In a considerable proportion of these cases pulmonary disease does not afterwards develop. In other cases the blood-spitting follows some unusual exercise or effort on the part of a young person in whom there are symptoms or physical signs of lung disease, but in the course of a few days, tubercle bacilli are found in the sputa. Or, the blood-spitting may occur abruptly in an individual who has been slightly ailing for some little time; and, upon examination, there are well-marked physical signs of lung disease and tubercle bacilli and fibres of elastic tissue are present in the expectorated blood or, somewhat later, in the sputa. The amount of blood in such cases is usually slight, but recurrence is common and may continue at intervals as the disease goes on. The blood-spitting of advanced cases is more abundant and not rarely fatal, as

the blood comes from the erosion of a blood vessel, or the rupture of an aneurism of a branch of the pulmonary artery in the wall of a vomica.

Whether the amount of blood brought up be trifling or considerable, the first blood-spitting is always the occasion of great alarm and anxiety on the part of the patient and his friends; when it is continuous or large, the physician often has cause to share in these sentiments. It is his duty, however, to exert himself to allay them and avoid panic. The early and slighter bleedings require no special treatment beyond absolute rest and quietude, restriction as to fluids and food, and a brisk saline purge. As these bleedings usually originate from overfilled vessels in a congested area, they are not always an unmixed evil. As recurrences take place, subsequently, at longer or shorter intervals, they excite less apprehension on the part of the patient, and it is not uncommon to have blood-stained handkerchiefs brought to the consulting room as evidence that hemorrhage has been going on for a day or so.

When the hemorrhage is profuse, the patient may bleed to death in a short time, and this catastrophe is to be averted in no other way than by the formation of an occluding thrombus at the site of the escape of the blood from the eroded vessel or the ruptured aneurism—an event over which the art of medicine has no immediate or positive control. The faintness resulting from blood loss contributes to thrombus formation, and the general pressure may be lowered mechanically by withholding the return of blood from the arms or legs or by temporary compression of the great veins using properly adjusted tourniquets, which should be gradually released if the bleeding ceases, and in no case allowed to remain beyond two hours. If time permits, and the side from which the bleeding comes can be determined, and the condition of the opposite lung warrants it, artificial pneumothorax may be produced; a large volume of gas is at once injected, with the view of controlling the blood flow by collapsing the lung, diminishing the size of and retarding the outflow from the cavity involved, and minimizing the cough. This operation, originally unsuccessfully employed by Cayley, has since been used with occasional gratifying results. Venesection, formerly practiced with the intention of lowering the blood pressure, has fallen into desuetude.

Between these two conditions, in the first of which the part nature plays is curative, in the second mostly destructive, there is much for the physician to do. He must insist upon complete rest. The semi-recumbent posture on a bed-rest or several pillows is better than lying with the head low. The arms are not even to be moved. It is better for the patient not to speak. Morphine by hypodermic injection is more reliable than codeine, mostly more available than heroin. The deodorized tincture of opium may be given in small doses at short intervals or chloral hydrate, a much neglected remedy, in the same way. These drugs are not only sedative and quieting to the nervous system; they are also cardiac depressants. By these measures the cough is likewise controlled. Their action must be closely watched. Minimal dosage may fail to sufficiently control

the cough and the succussion and dyspnœa may dislodge a beginning coagulum; a dosage too liberal may lower the cough reflex and permit the bronchi to flood with blood. Fragments of ice dissolving in the mouth are helpful. A few whiffs of chloroform occasionally may do good. There is a scientific basis for the use of calcium lactate and sodium chloride, which increase the coagulability of the blood. But their action, when given by the mouth, is slow. The latter may be given intravenously. There is no place in the treatment of the blood-spitting of tuberculosis for ergot, atropine, emetin or turpentine. Nor would I use gelatine. The efficacy of horse serum and various blood-coagulating proprietary preparations derived from it in the treatment of this form of hemorrhage remains to be established. Continued bleeding may come from a persistent local congestion on the one hand, or from a small lesion in the wall of a blood vessel or a minute aneurism on the other, and may cease spontaneously at any time. Saline purgatives, among which magnesium sulphate stands first, should be given at intervals. Notwithstanding thirst, the intake of fluids should be limited. Rest in bed should be maintained for several days after blood-spitting and the expectoration of the small dark casts of the bronchi and the transient fever, which are frequent sequels, have ceased. A tendency to recurrence demands a restriction of ordinary physical activities.

Dyspnœa.—This respiratory symptom is curiously infrequent in ordinary pulmonary tuberculosis. Extensive involvement of one lung may coexist with well marked disease at the apex or elsewhere on the other side without shortness of breath, except upon exertion. The respiration frequency in many cases is but moderately accelerated during the febrile paroxysm. It may be associated with cyanosis and is often cardiac. In advanced cases it is occasionally very distressing. The air of the room should be kept in motion by an electric fan or the patient moved to an open window in suitable weather; diffusible stimulants as ammonia and alcohol usually afford some relief, and caffeine, camphor or strychnia may be given hypodermically. These measures failing, a few whiffs of chloroform may be given. There is always in reserve the hypodermic injection of morphine.

Fever.—This symptom is one of the manifestations of the toxæmia caused by the growth and multiplication of the tubercle bacilli in its action upon the heat centers. In small circumscribed infections, with good resistance on the part of the invaded tissues, the fever-producing toxin is not sufficient in quantity to cause febrile temperature. More abundant infection, coupled with feeble powers of resistance is associated with fever, the intensity of which corresponds to the activity of the tuberculous process. And as this process extends to progressively increased tissue masses, whether in lymph or other glandular structures, bones, joints, or the lungs, more and more toxin is produced and new accessions of fever take place. There is more or less autoinoculation, each advance of the infection being followed by fever in the same manner as an injection of tuberculin has its febrile reaction. The local irritation of multiplying tubercles stimulates the surrounding tissues, and produces an increased afflux of lymph and blood;

bodily activities, by which the physiological processes of the circulation and respiration are brought into fuller play, have a similar effect; and herein lies at once an explanation of many of the peculiarities of the fever of tuberculosis, and a clear indication for the fullest employment of rest in the management of the disease. Fever, except in the mildest cases, is an early and most important symptom; a patient at rest may be quite afebrile; after moderate exercise his temperature may rise to 102° F. (38.9° C.) or more; after violent exercise to 103.5° F. (39.6° C.). In the moderate fever of early, favorable cases, the highest temperature in the diurnal range is in the later part of the day, six to eight P. M. After the night's repose it is usually normal or subnormal. Departures from this rule are not uncommon, and it is therefore necessary to make observations at frequent intervals. Every two hours for a day or two will often reveal a distinct, though not marked, rise at some other hour; the repetition of the observation a few days later may show this rise at a particular time to be constant. It is then significant and search must be made for the cause. In mild and incipient cases the departures from normal are not large and the maxima, instead of occurring about 8.00 P. M. may be encountered anywhere between 2.00 and 6.00 P. M.; the minima, instead of about 8.00 A. M. anywhere between 2.00 and 6.00 A. M. Inverse temperatures are occasionally observed. Very exceptionally, there is an entire absence of fever in severe cases. In very acute cases the range is sometimes subcontinuous like that of enteric fever. There is a group in which the fever, of distinctly remittent type suggesting a quotidian malaria, is the first symptom to attract the attention of the patient; but in these cases there is always, upon close questioning, a history of previous ill health and cough, and the paroxysms do not have the regular recurrence of those of ague. Hectic fever, which is characteristic of advanced tuberculosis, is due to mixed infection, and is a distinctly septic process. It is associated with the presence of pyogenic organisms and supuration. There is rapid tissue destruction and cavity formation. Tubercle bacilli are very often not found in the sputum.

Rest, in the ordinary cases, is the proper treatment. As the fever abates, after a night's repose, only to rise again after the activities of the day, and can be shown to gradually cease in the great majority of cases after continuous rest; and as it is found that the more complete the rest the more rapid the relief, the therapeutic indication is clear. This treatment can be carried out at home or in a sanatorium. Fresh air is an essential part of it, and the necessary arrangements can be made even in city life, where the circumstances at first sight appear most unfavorable. The patients can be trained to combine a continuous rest cure with fresh air treatment, and the results are in many cases unexpectedly gratifying. The main elements are rest in bed, open windows all day and all night long, and a carefully regulated, abundant but not excessive diet. Plenty of fluid, milk, water, fruit juices are helpful. Cold weather is not a contraindication. If there is an open gallery, so much the better; and on bright days the patient may be carried out into the garden or yard and spend some hours in the sun,

well wrapped up and protected from the wind by a screen. In a country home such a cure finds fewer difficulties to overcome. Very disheartening symptoms, cough, expectoration, even blood-spitting, should not stand in the way, and rest and the open air are really curative alike for the fever and the disease. Perseverance is necessary. Weeks, even months, may be required to bring to pass the desired result.

The disagreeable subjective sensations that attend marked rise of temperature in other diseases are often absent in the fever of tuberculosis. The gaiety and animation of the consumptive during the evening hours are a frequent subject of remark. It would appear that the toxins of tuberculosis have a stimulating effect on the cerebral cortex. This may account for the *spes phthisica*, which is a remarkable characteristic of the disease. So-called antipyretic drugs are not required in the management of ordinary cases of pulmonary tuberculosis. In fact, they act as depressants and increase the tendency to excessive sweating. In special cases phenacetin and caffeine may be given, or potassium citrate with spirit of nitrous ether. Tepid sponging and alcohol rubs are refreshing; but the application of cold is mostly disagreeable to the patient. The hectic of advanced phthisis is like the fever of sepsis in general. But the foci, of which there are many, are out of the reach of the surgeon's knife. It remains to use the hypodermic needle, to be very indulgent to the *spes phthisica*, and to guardedly employ alcohol in moderate doses.

Sweating.—This symptom, early in the course of the disease, is disagreeable, rather than serious. Relief commonly follows continuous rest and fresh air. Sweating is apt to occur at night, the patient waking drenched and most uncomfortable. If practicable, he should be dried, rubbed with alcohol, and have fresh night clothes. An alcohol rub at bedtime is beneficial. The covering should be of medium warmth and night clothes of light flannel are preferable to cotton. In advanced cases, night sweats are difficult to control. Atropine, camphoric acid, picrotoxin and full doses of tincture of *nux vomica* are often given, but not always with success. Full doses of aromatic sulphuric acid, taken regularly for a few days, sometimes appear to be beneficial. When cough and restlessness are present, the hypodermic injection of a moderate dose of morphine acts as a synergist.

Chest Pains.—These are of two kinds; rheumatoid pains, common in badly impaired health, which may follow exposure to cold, a change in the weather or overexertion, and are usually relieved by hot applications, sometimes by cold, mustard plasters or proprietary analgesic ointments containing oil of wintergreen, menthol or camphor and chloral. Ointments depending on phenacetin or iodine are also useful. Chest pains due to pleurisy are much more common. Repeated small doses of Dover's powder, acetylsalicylic acid, phenacetin, or the newer tolysin in five grain doses afford relief, or these failing, the chest may be partially immobilized by strapping. Dry cupping is much in vogue, but very uncertain, and this is also true of light touches with the actual cautery.

Digestive Disorders.—With two exceptions, there is nothing characteristic of the gastro-intestinal derangements of pulmonary tuberculosis. These exceptions are: first, a troublesome diarrhœa, which too often is but little controlled by treatment, and is symptomatic of intestinal tuberculosis with ulceration; and second, an equally intractable constipation, often due to a gradually increasing narrowing of the lumen of the gut in consequence of the formation of scar tissue and adhesions, in which enlarged mesenteric lymph glands are entangled. A tumor mass is formed suggestive of chronic inflammation of the appendix, which is in fact frequently involved in the tuberculous process. The true nature of these conditions may be recognized by the presence of tubercle bacilli in the fæcal matter, or in the discharge from fistulæ which may be formed in the advanced cases. *Fistula in ano* is a lesion not rare in tuberculosis of the rectum. These conditions are not very hopeful material for surgical treatment. The last, however, is very often cured by free excision. An operation which consists in merely laying the tract open, does not often give permanent relief; and justifies the common fear that such treatment may accelerate the progress of the disease in the lungs. In the midst of failure in the medical and surgical treatment of intestinal tuberculosis, we may look with some degree of hopefulness to a combination of rest, the best possible nutrition under the circumstances, and heliotherapy instituted at the earliest possible moment after the tuberculous nature of the trouble is suspected. The symptoms of tuberculosis of the peritoneum are mostly of gradual onset. Even in the acute miliary type, though their development is rapid, it lacks the fulminant character of the septic forms. In other respects the symptomatology is not characteristic. For this reason the diagnosis in those forms, in which a tuberculous focus elsewhere in the body cannot be located, is frequently obscure. It may, however, be made with confidence when the peritoneal inflammation develops in an individual suffering from tuberculosis of the lungs or in any other organ. Treatment by medical measures may be employed in the acute miliary, the ulcerative and the fibrinous type; in the encysted types it must be supplemented by surgery. It is estimated that 50 per cent. of all cases under a properly carried out open-air rest cure recover. Of the remainder one-half are much benefited or cured by operation. Medical treatment should therefore be instituted at first; but that failing, recourse to surgery becomes necessary, especially when the disease is, insofar as can be ascertained, confined to the abdomen. The removal of a primary focus of infection, which may be found to be situated in the cæcum, appendix, or elsewhere in the gut in the form of ulceration, the mesenteric lymph-nodes or the fallopian tube, is sometimes followed by the subsidence of the tuberculous inflammation, the formation of adhesions and permanent cure.

The non-specific disorders of the stomach and bowels, to which the tuberculous patient in common with other persons is liable, require the ordinary measures of treatment. It is fortunate that the overfeeding with milk and raw eggs, at one time entering so largely into the management of

such patients, has given place to more reasonable dietetic rules. Symptoms referable to the gastro-intestinal tract are present, in the great majority of cases, at frequent periods in the course of the disease; and as the maintenance of the nutrition is an essential factor in its successful management, the correction of the causes of such symptoms is among the most important duties of the physician.

Nervous Symptoms.—The nervous system partakes of the malnutrition which, as a result of toxæmia, pervades the whole body. Aside from variations in temperament, patients are emotional, too responsive to physical and mental stimuli, easily fatigued. Insomnia is common. They are filled with doubts and fears. The idea of endless days and nights in bed with nothing to do is overwhelming. Some trifling looseness of the bowels means intestinal tuberculosis; a passing twinge of pain, pleurisy; a cough at night and there must be a light to see if there is blood-spitting. All this, which to the physician who is seeing new patients from time to time means little, is to the patient the most dreadful part of his malady. It is under these circumstances that the physical element of treatment looms large. To make the patient see clearly and at once the danger of his condition, the hope of cure, and the necessity of a resolute determination to put away useless anxieties and fears, is the gift of the accomplished and successful physician. Rest and fresh air and a well-regulated diet are very helpful. The bed must be comfortable, with coverings suitable to the weather and climate. If the early light is annoying and prevents sleep, the bed can be screened; cough and night sweats are to receive due attention. Warm sponging, an alcohol rub, rearranging the pillows, some light nourishment, a glass of milk with a cracker, a cup of cocoa may be followed by sleep. Until he becomes accustomed to the new conditions, the patient must not be allowed to think that he is neglected.

If insomnia persists, drowsy medicines may be given—veronal, the bromides, chloral hydrate in small doses repeated once or twice; not opium or its derivatives; and the patient must not know what drug he is taking.

After a variable period the febrile patients in whom recovery is taking place, enter upon a period of convalescence. The temperature may not at once fall to normal and remain so. In fact, oscillations of a degree or so, even occasional temporary rises to sub-febrile ranges 99.5°-100.5° F. (37.5°-38.1° C.), are not uncommon. It is in most cases best to still continue the rest in bed, but from this time the mental diversion of light reading or study, or such occupations as basket-weaving or knitting, or an occasional game of checkers or cards, occupations and amusements suited to the tastes of the individual and given up upon the first sensation of fatigue, are very useful. When the range of temperature no longer exceeds normal, systematic graduated exercises form a welcome and important part of the treatment. Walking is at first prescribed; but the daily monotony of this use of the muscles in the open air is gradually replaced by light, useful, out-door work, as gardening, attention to the lawn and shrubbery, the care of the poultry and animals, and other duties about the place. Competitive games, tennis,

rackets, handball, even golf, must be postponed until the arrest of the disease is definitely established. This postponement is not necessary in the case of croquet.

Emaciation.—The synonyms “Phthisis” and “Consumption” are expressive of the fact that tuberculosis is essentially a wasting disease. The action of the toxæmia upon nutrition is two-fold. It impairs digestion and depraves assimilation. Not forced feeding and hyperalimentation are indicated, but measures which favor encapsulation and delimitation of the local tuberculous processes. It is not that the patient should be urged to eat more food, but that he should be persuaded to realize the advantages of eating less. Some degree of hunger will often prove the beginning of a better appetite, and a good digestion waits on appetite. Three well-balanced meals a day are in most cases better than several small meals; but there are cases in which the latter plan is necessary. It is needless for either the patient or the physician to give much attention to the subject of calories; but the fact that mineral salts, as present in the leaf vegetables and fruits, are essential to a normal diet is not to be overlooked. Furthermore, the part played by those unidentified chemical substances, called vitamins, which are present in the pericarp of various grains and in fresh fruits, vegetables, eggs, raw milk, cream and other natural foods, is not to be disregarded in arranging the dietary. One of the early signs of the improvement, arising from treatment by rest in the open air, is a return of the desire for food. The cure of tuberculosis is a question of nutrition. It is, however, a cardinal error to regard mere increase of weight, in the absence of other favorable conditions, as indicating an improvement in the disease.

The Causal Treatment Of Pulmonary Tuberculosis.

The modern history of tuberculosis is a record of great achievements in scientific medicine. From point to point, by close observation and the connotation of facts, by untiring research and the comparison of results on the part of innumerable investigators in every part of the civilized world, knowledge has been making steady progress. This advance has been marked by the discarding of traditional errors and the accumulation of new truths concerning the causation, pathology, symptomatology, diagnosis and prophylaxis of the disease, and above all, by the epoch-making discovery of the tubercle bacillus. Conspicuous among the leaders in this great movement are the names of Auenbrugger, Laennec, Bayle, Villemin, and first among the foremost, Robert Koch. Therapeutics has lagged behind not for the want of labor or leadership, but because, in the nature of things, empiricism having failed, the art of healing must follow a knowledge of causes, and the pathology; and, it must be added, because of the difficulties of interpretation and a too-eager haste to try all things before holding fast to that which is good. The presence of ozone in the atmosphere of coniferous forests at high altitudes, a hypothetical explanation of the favorable effects of one form of open-air treatment, and a restful life, and behold, the up-to-date practitioner converts the upper floors of his city house into a

solarium thick beset with evergreen shrubbery; and his unfortunate patients make daily pilgrimages to it, climb many stairs, and spend an hour or two deeply inbreathing the ozone. The premise being unsound, the conclusion is absolutely wrong; the patient doing harmful things is not better but worse, and the *ignis fatuus* of ozone in the city has proved a step backward. Tubercle bacilli in the pulmonary lesions? What more simple than direct treatment by the inhalation of some germicide from a charged atmosphere or by spraying or the injection of such substances through the chest wall into the very seat of the lesions? And so on through a long list of unverified conclusions, unproved hypotheses, and bitter disappointments. Trudeau at Saranac, himself a patient, but endowed with enthusiasm, energy and the scientific spirit, led the way in the United States to a reasonable method of living as a means of cure, in which every detail corresponds to a phase of the malady and shows how it can be successfully taught and practiced in a sanatorium.

Much has to be learned before we can be assured of an efficient treatment of tuberculosis directed against its cause, and many things unlearned. It is perhaps best to restate some of the chief facts upon which an etiological or causal treatment depends.

(a) *As to the cause itself, it is bacillary, Bacillus Tuberculosis.* Four varieties are recognized: the human, the usual cause of tuberculosis in man; the bovine, the cause in cattle and to some extent in man, especially at an early age; the avian, the cause of the disease in birds; and the reptilian or tubercle bacilli of cold-blooded animals. The last are not pathogenic, even to animals in which they are present.

(b) *Distribution in the Body.*—Tubercle bacilli may be found in every organ and tissue of the body, most frequently in the lymph-nodes and lungs.

Distribution outside the Body.—The tubercle bacilli has no permanent habitat outside the body of warm-blooded animals. Its main source is the recently expectorated sputum of human beings suffering from pulmonary tuberculosis.

(c) *Mode of Transmission.*—Inhalation and ingestion are the chief methods. Inoculation and contact conveyance play a comparatively insignificant part.

(d) *Hereditary Transmission.*—This theory, long a stumbling block in the way of knowledge, has been shown to be untenable by tuberculin tests in the newly-born children of tuberculous mothers and the offspring of tuberculous cows and laboratory animals.

(e) *Behavior of Bacilli after having found Access to the Interior of the Body.*—The familiar description "An infectious disease arises when a pathogenic organism, having entered the body, grows and multiplies, and in doing so produces specific derangements of physiological processes" is available. The tubercle bacilli may remain quiescent for a long time and be widely distributed in lymphatic tissue. Their presence under these conditions cannot be called an infection. Their growth and multiplication very often causes merely a slight local infection. This limited

reaction is due to a very general immunity and its occurrence, at or before the age of puberty in about 90 per cent. of children in cities, has been demonstrated by tuberculin tests or by autopsy.

(f) *Typical infection* in pulmonary tuberculosis may be due to bacilli, long quiescent, breaking loose and reaching the lungs by way of the blood or lymph current, and there producing characteristic lesions and symptoms, or to more rapid or more direct invasion in a non-immune subject. The primary invasion of the lungs, which does not cause symptoms, constitutes a local and circumscribed infection; when there are multiple foci or an active extension from the original site, attended with symptoms, the pulmonary tuberculosis becomes a general infectious disease. Although a group of cases run a rapid course, it is, however, essentially chronic, as new foci tend to develop from time to time, each in its turn causing destruction of tissue and exacerbation of the symptoms. When from any focus large numbers of bacilli are at once swept into the blood stream and distributed throughout the body, lodging and developing tubercles in many organs, about the same time a typical acute infection takes place which runs a rapidly fatal course.

(g) *Mixed and Terminal Infections*.—Pyogenic organisms are commonly present in sputum, and in the inflammatory lesions, post-mortem streptococci, staphylococci, pneumococci are also present. Recent studies show that these organisms play no necessary part in causing the lesions and that the tubercle bacillus is the active agent in the causation of all the inflammatory and destructive tissue changes characteristic of the disease.

(h) *The Degeneration of Tubercle*.—Two processes go on, usually side by side, sclerosis and caseation. Of these, the first is conservative, the latter destructive. The result is determined by the general health of the host, and nutritive conditions of the surrounding tissues. If favorable, the tubercle focus becomes encapsulated in fibroid tissues with the formation of a firm nodular mass and calcification; if unfavorable, it undergoes softening and necrosis, forming a cheesy detritus in which bacilli are numerous, and from which, by soakage and insufflation, they are conveyed to neighboring areas.

(i) *Rest of the body* conserves energy and promotes nutrition; it is attended by quiet breathing and circulation, rest for the lung, and favors fibrosis. Hurried respiration and deep breathing conduce to local congestion and softening of the tuberculous new tissue. Shallow respiration, pleural adhesions, and somewhat increased tonicity of the muscles of the chest wall are natural indications of the need of rest for the diseased lung.

The obvious measures for a plan of treatment for pulmonary tuberculosis directed against its cause consist in rest in the open air, a carefully regulated nutritious diet, and the alleviation of symptoms.

Such a plan may be carried out at home, in a favorable climate, or in a sanatorium. Many of the details have been considered under the heading "The Treatment of Symptoms" to which the reader is referred. It is of primary importance that treatment should be commenced early. Of cases in which energetic measures of treatment are instituted, at a time when

tuberculosis as a cause of symptoms or of impaired general health is suspected, 80 per cent. recover. When such treatment is not begun until, after temporizing, tuberculosis is the obvious cause, not more than 20 per cent. recover.

It is essential that insofar as is possible, the physician should secure the confidence of the patient. To this end, if the latter is an intelligent person, he should be told the true nature of the malady, the method and purpose of the treatment, and the hopefulness of an arrest of its progress. It should also be made plain to him that a restoration to health may require a long time, in order that he may arrange his plans accordingly. In the suspected cases, after a short period of rest the temperature falls to normal. Exercise may be gradually increased until it reaches an unrestricted stage, and in the course of a few months the patient may resume his usual occupation. Individuals who have passed through this experience should report from time to time for examination.

The Home Treatment.

The great majority of cases must, of necessity, be treated at their own homes. The general measures for such a method have been outlined in the foregoing section on the Treatment of Symptoms. The difficulties of the home treatment in the early stages, when the treatment is most likely to arrest the disease, are in many cases almost insuperable. Much, however, can be accomplished by making the patient understand the situation and realize the necessity of cooperation. He feels the importance of working while he can; there is the difficulty of securing treatment in the overcrowded state institutions; the medical service in the dispensaries is overworked, and the outlook is discouraging. Too often the disease goes on until treatment is useless, and the only refuge is the hospital for advanced and incurable cases. There is, fortunately, a large contingent of cases that can be treated at home even in cities. In the country the open-air rest treatment has fewer difficulties. Much help can be obtained from the various antituberculosis organizations, among which the tuberculous classes of Pratt are very useful. When practicable, patients who are unable to take a prolonged course of sanatorium treatment should, as early as possible, by a few weeks' sojourn, avail themselves of the training which can only be obtained in such an institution.

The Climate Treatment.

The favorable influence of a residence in certain climates for those suffering from chronic disease of the lungs has long been known. Localities in which tuberculosis is infrequent among the inhabitants, and in which persons suffering from such diseases have improved and regained a degree of health sufficient for the enjoyment of life and the resumption of their ordinary activities, have naturally acquired a wide reputation in this respect, and for a long period a change to such regions was thought essential to a cure. This opinion is no longer generally held. Many patients

recover who are unable to avail themselves of any advantages accruing from a change of residence; it is not always possible to determine in advance the climate to which the patient should be sent; the accommodations, the food, the social conditions must be considered; above all, the lure of climate for advanced consumptives who too often are without means of support; finally, the fact that for many early cases so radical a measure of treatment is needless, and for a still greater number of the late cases, altogether hopeless. All these considerations have served to bring about a more reasonable and conservative estimate of the value of climate.

Climate is only a variation of one factor in the open-air treatment. From this point of view, its greatest value is in the treatment of the suspected cases, those that are convalescent but tend to become chronic, and those actually chronic, especially those having extensive consolidation, cavity formation, or lesions in both lungs, without active symptoms. The requirements are purity of the atmosphere, an equable temperature, and much sunshine. Where these coexist, sanitoriums now abound, and the local surroundings are attractive for the homes of families in which a peculiar disposition to tuberculosis exists.

So many elements enter into the complex natural condition that we vaguely designate by the term "climate" that it is impossible to summarize them satisfactorily for the purposes of medical advice. In fact, climatology, that science which has for its object the consideration of this subject, has not yet formulated satisfactory rules for the use of the therapist.

The long-established grouping of climates into high altitudes, the dry, warm and moist warm, the last being subdivided into the littoral and the maritime, is convenient for general purposes.

High Altitude Climates.—To this group may be assigned as favorable for patients suffering from tuberculosis, Colorado, New Mexico, Arizona, and the mountains of Western Canada and British Columbia. Of lower elevation, but having the mountain quality, if one may use the term, are the Adirondack and Catskill Mountains, of New York, the high Alleghanies of Pennsylvania, North and South Carolina and Virginia, the Laurentians in Eastern Canada, in America. In Europe, the localities of this group are Davos, the Engadine, and St. Moritz.

Dry Warm Climates.—In this group may be classed the resorts of Southern California, Aiken, Thomasville and the Sand Hills of Augusta; and beyond the Atlantic those of the Riviera, from Hyères around by way of Naples to Sorrento and the Island of Capri; and, south of the Mediterranean, Algiers and Egypt.

Moist Warm Climates.—The best littoral climate of the United States is that of Florida. On the East Coast, however, the patient must shun the sudden fall of temperature that occurs with the morning inrush of the sea breeze, and be equally on guard against the northers which occasionally blow fiercely from the northwest against the West Shore. The best resorts

for the consumptive are along the backbone of the state, among the lakes midway between the Atlantic on the east and the Gulf on the West.

As to maritime climates, Nassau and the Bermudas, off our Atlantic Coast; the Madeira Islands; Bournemouth, Torquay and Falmouth on the southwest coast of England, and the Channel Islands are satisfactory; and as health resorts all these are pleasant places in which to live. The chief advantage of what is regarded as a *good* climate is that it favors a life in the open air. Cold weather is no disadvantage. At Saranac the temperature often falls below zero, but it is no hardship for the patients, who gradually become accustomed to it, to be out of doors throughout the winter.

The Treatment in Sanatoria.—These institutions have been established in favorable localities in all parts of the civilized world. At first under influence of the prevalent belief in the importance of a favorable climate, sites were selected in carefully chosen regions, as Görbersdorf in the Sudetic Mountains and Saranac in the Adirondacks. Later, under more conservative views upon the subject, they began to appear in various accessible regions and many are now found in salubrious localities within easy reach of large cities. Mostly built for a definite purpose, they fulfil every requirement as to outlook and exposure and internal arrangement, and are equipped with suitable laboratories for clinical and experimental research, special accommodations for officers and nurses, halls for the assemblage of patients, libraries and so on. Provision is also made for out-door exercise, and suitable amusements for convalescent patients, and there are usually kitchens and flower gardens in which they may work. The original design was the treatment of persons suffering from tuberculosis, but in response to an obvious need and opportunity, there has gradually developed to a very high degree an educational influence upon the patients, and through them among the people at large, which has in turn extended to practitioners of medicine. The opportunities for intensive study on the part of the medical officers has resulted in the acquisition of knowledge that otherwise would have been unattainable. Most sanatoria receive only incipient or moderately advanced cases in which there is a reasonable expectation of improvement. The patients are obliged to live under rigid discipline, but as the evidences of improvement are observed by newcomers, and a general spirit of hopefulness is displayed, the compliance with strict rules soon ceases to be a hardship. The length of time over which the treatment extends varies according to the degree of progress the disease has made, the response to treatment, and the nature of the convalescence. It is vain to hope that even an incipient case can properly be discharged in less than six months. Of course, patients admitted with the understanding that they are received to learn how to properly take care of themselves and avoid becoming a source of infection to others, may acquire that knowledge in a shorter time. When the response to treatment is prompt and satisfactory, and exercise has been progressively increased without return of fever after six months or more, the patient may be allowed to return to his home. The subsidence of special symptoms is not the whole story; the restoration to

normal general health is equally important. Many months may pass before this is accomplished. The development of fibrous tissue, by which healing and encapsulation of the lesions takes place, is a slow process. The return of the patient to his usual physical and mental activities is always a tentative undertaking, and must be gradual and cautious. The expense of sanatorium treatment is a very serious consideration and is prohibitive to the majority of patients. Many of the private institutions are supported by endowment, contributed or bequeathed by philanthropic persons; and in every state in the Union there are public sanatoria for early cases and hospitals for the advanced cases. The immediate results are, in general, very satisfactory and the late results compare favorably with other plans. There is much satisfaction alike to the patient and the physician in a method based upon actual conditions, in which every phase of treatment is in response to a clear indication, and in which the motive is to develop a mode of life favorable to a cure, rather than to establish a dependence upon drugs which are uncertain at best.

In the Trudeau Sanatorium, which is a model institution, there were treated, from its founding in 1884 to the end of 1917, a period of thirty-three years, 4,316 patients. Of these, at the close of the period, 36.6 per cent. were well; 17.9 per cent. were living, but not well; 37.8 per cent. were dead, and 7.7 per cent. could not be traced. (Paterson). These patients at the time of admission were, in accordance with the rules of the institution, either "early cases or those moderately advanced and giving promise of improvement."

Dispensaries.—Tuberculosis clinics under the care of especially trained physicians are maintained in connection with the large general hospitals in cities. The patients are given systematic instruction in regard to their disease, and such directions and prescriptions as are required. Similar dispensaries are also conducted by antituberculosis organizations and are very important and useful in small communities unsupplied with hospital facilities. An important function of these dispensaries is the differential diagnosis and it occasionally happens that a serious error can be corrected. A well-trained visiting nurse adds greatly to the efficiency of this phase of antituberculosis work, and extends its usefulness. When it is necessary patients are referred to the proper sanatorium or hospital and fully informed as to the manner in which the application for admission to it must be made.

Classes In Tuberculosis.—This method of popularizing knowledge concerning consumption, its prevention and treatment, originally suggested by Pratt, of Boston, more than a decade ago, has proved a very serviceable adjunct in the antituberculosis movement. The classes hold meetings once a week and consist of ten or twelve patients, usually referred from the various dispensaries. A physician presides and a visiting nurse is in attendance. They are in the nature of experience meetings. The patients are weighed and report the course of the malady, and anything of special importance that has occurred. Matters of common interest are brought up for

consideration. Questions are asked and advice given. Sympathy is aroused and a spirit of helpfulness developed. This sort of comradeship is very advantageous among the incipient, arrested and chronic cases that such organizations bring together.

Sanatoria and other similar institutions perform a most important work in caring for the individual patient, but their greatest usefulness is educational. This influence is extended widely throughout the community in various ways, but chiefly by the discharged patients who have, during the treatment, acquired a practical knowledge of their disease, and the precautions by which its transmission to others may be prevented. They have also gained more intelligent and enlightened views of the value and desirability of the possession of healthy bodies and of hygienic living, and are in a position to express their knowledge of these subjects with a degree of confidence and earnestness that cannot fail to secure the respectful attention of their associates. In this way, often unconsciously, they become crusaders in the antituberculosis movement, and exert a power for good in communities in which tuberculosis is prevalent, where they come into personal touch with the people, with whose habits and modes of thought they are familiar.

There is, however, an aspect of the subject which must never be overlooked; namely, the fact that many patients, leaving sanatoria improved and able to go to work, are *carriers*. They are potential, and always liable to become actual foci of distribution for tubercle bacilli without being aware of it. The lesson of this possibility should be a subject of sanatorium instruction, and urged upon every convalescent patient as a reason for reporting to the institution or his local physician at regular intervals for a general and bacteriological examination.¹

Treatment By Medicines.—There is no specific. Innumerable drugs have been tried and found wanting. Antiseptics which exert an inhibitive or destructive action upon tubercle bacilli *in vitro* have been vainly employed in the treatment of tuberculosis by the mouth, by inhalation, by subcutaneous, intramuscular, intravenous injection, directly through the chest wall, and by laryngeal and tracheal injection. The relation of the infecting organisms to the cells entering into the formation of tubercle, where they grow and multiply, and their inaccessibility to hostile medicaments, either by direct approach, being protected by fibroid limitation or by the caseous detritus in which they abound, or by way of the blood flow, which is limited in sclerotic tissues and altogether absent in the cheesy masses, explain the uselessness of such measures directed against the cause of the tuberculous disease. They have therefore, with good reason, been abandoned. The search by the methods of chemotherapy have yielded no better results. No medicinal substance curative by a direct, selective action upon the bacillus in pulmonary tuberculosis has yet been discovered.

¹ The National Association for the Study and Prevention of Tuberculosis issued some years ago a Tuberculosis Directory containing a List of Institutions, Associations and other Agencies dealing with Tuberculosis in the United States and Canada. This work may be consulted at almost any Medical Library or may be obtained at No. 105 East Twenty-second Street, New York City.

It remains to consider certain medicaments which have the reputation of improving the general nutrition and thus increasing the defensive reaction of the body against invasion. The continuous or occasional use of remedies of this kind may be justified by the fact that the tubercle is the anatomical basis of tuberculosis; that it primarily involves a limited area of tissue and is, therefore, a focal disease from which extension takes place by invasion of the surrounding tissue, in which new tubercles are produced. The object of such treatment is to fortify this surrounding tissue. Among the more important of the remedies which appear to act in this manner are:

Creosote And Its Derivatives.—These drugs have long been used. They are frequently given with advantage in cases attended with excessive expectoration having, like other drugs exhaled by the respiratory mucous membrane, a beneficial influence upon bronchitis. Pure beechwood creosote is better borne by the stomach and guaiacol or guaiacol carbonate are to be preferred. These drugs should be given in capsule or pill. Their administration in combination with cod liver oil, glycerine and whiskey, or hypodermically, or by enema is not to be recommended. With the intention to control the tendency to demineralization they are sometimes combined with calcium salts. This treatment cannot, however, fully take the place of milk, in adequate amounts, derived from pasture-fed cows, and the green vegetables from which the mineral elements necessary to normal nutrition are usually obtained.

Cod Liver Oil.—This animal fat was long looked upon as a specific for pulmonary tuberculosis. Pure Norwegian oil was exported to the most distant countries and eagerly taken in large amounts. Various modes of administration very often failed to render it acceptable to the fastidious palate of the invalid, who could neither take it by the spoonful, as an emulsion with syrup, egg albumen, malt extracts, hypophosphates, or in any other way. Even capsules containing cod liver oil frequently aroused the repugnance of the patient. In recent years this remedy lost its vogue, the increase in weight following being too often due to fat and unattended by improvement in any other respect. Just at present, owing to its remarkable effect upon rickets and some other nutritional diseases, an action sustained by laboratory research, cod liver oil has regained much of its old reputation as a remedial agent. Young children bear cod liver oil well and eagerly take the appropriate doses in the form of a well-made emulsion with syrup of the lactophosphate of lime. Inunctions of this oil after the daily bath are a useful adjunct to the treatment of puny babies.

The Hypophosphites.—These salts are thought to exert a favorable influence upon nutrition in a general way, and especially in relieving certain of the symptoms of pulmonary tuberculosis. Some authorities still recommend the administration of the sodium salt in the early stages and the calcium salt in the later stages, but deny the usefulness of the potassium salt at any period in the course of the disease. Others deprecate the employment of these salts in states of malnutrition due to any cause. The

extravagant claims made for them for many years have not been realized, either in the treatment of phthisis or of nervous disease.

Arsenic.—The usefulness of this drug in wasting diseases and anæmia has long been recognized by therapeutists. Its employment is justified in afebrile, chronic and quiescent cases. The recent development of arsenotherapy by the addition of cacodylic acid and its salts, atoxyl and other preparations of lower toxicity has extended its sphere of usefulness. Its action upon the blood must be determined and regulated by systemic blood counts at regular intervals.

Specific Treatment.—These forms are to be briefly considered: Tuberculin Treatment, Vaccine Treatment, and Serum Therapy.

Tuberculin Treatment.—This method, introduced by Koch in 1890, was widely employed for a time; but the violent reactions and frequent fatal results that followed the injudicious administration of large doses of the original tuberculin led to its practical abandonment. Continual experimental and more cautious clinical work followed, and for a long period tuberculin and various modifications of it were again very generally used both in sanatoria and in private practice, but in doses so small that no reaction was produced beyond slight evidences of local inflammation at the point of inoculation. After some years critical studies of the early and remote results, and the comparison of large statistics of cases thus treated with those in which tuberculin was not used, other conditions being nearly similar, make it clear that, in the absence of reaction, tuberculin is without curative effects. Tuberculin when given in sufficient doses, however, produces a distinct inflammatory effect in and around tubercles, as is shown in laboratory animals killed during the reaction, and in patients suffering from accessible tuberculous lesions in the larynx, conjunctiva or the skin (lupus). The favorable local effects observed under these circumstances form the basis for its continual employment among a limited number of enthusiasts. In pulmonary tuberculosis, where the lesions are in all stages of development or degeneration at the same time, and beyond the reach of direct observation, we have no accurate means of gauging the effects upon the tuberculous foci; or of so regulating the dosage as to escape the absurdity of a long-continued treatment with useless minimal doses on the one hand, and the danger of even occasional overdoses on the other hand. Even those who still advocate the tuberculin treatment of pulmonary tuberculosis restrict its employment to carefully selected cases, preferably those in which the early symptoms and the general condition have improved, but cough and expectoration persist and the course of the disease has become chronic. Such cases do well, particularly a group having serious laryngeal involvement. Patients with acute symptoms and, in particular, acute fever are unsuitable for this treatment.

The forms generally employed are Old Tuberculin—O. T. Koch; Bouillon Filtré, B. F. (Denys) and Bacillen Emulsion—B. E. (Koch). The method: hypodermic injection. The dosage: 0.000,000, 1 cc. If no reaction occurs, the injection is repeated at intervals of three or four days, the

dose being doubled each time. When tenderness and swelling appear at the site of inoculation, the treatment is stopped. When these symptoms subside, as they commonly do in the course of several days, the treatment is resumed, the dose remaining the same. No results following, the dose is again doubled as before. Immediately upon the occurrence of a febrile reaction, the patient is put to bed where he remains until again afebrile, but the injections are not resumed until the fever has been wholly absent for some days. By this gradual progress the maximum dose which fails to cause reaction is ascertained, and the treatment is continued at longer intervals and with gradually diminished dosage for several months. Should fever again occur during this period, the patient is kept in bed until wholly afebrile. Careful thermometric observations are required; in some instances at regular two-hourly intervals.

Vaccine Treatment.—The claims made about a decade ago by Friedmann, that he had successfully employed a vaccine made from the tubercle bacilli of turtles in the treatment of human tuberculosis, were abundantly proved to be wholly without foundation at the time. It is of interest to record the fact that statistical studies of the end results of this treatment recently made by various observers, concur in conclusively showing its worthlessness. The employment of vaccine for the relief of symptoms caused by secondary pyogenic organisms does not rest upon a satisfactory scientific basis and has not come into general use.

Serum Treatment.—The conception of a curative serum for animals immunized by tubercle bacilli or their products, corresponding to antidiphtheritic serum, was at one time widely prevalent among investigators. Sera employed with this object in view were obtained from various animals. Two of these products which attracted special attention were those of Marmorek and Maragliano. This method of treatment has proved unsuccessful because these sera have been shown not to contain antitoxic substances. Tuberculosis as an infecting disease has a prolonged and indefinite period of latency, in no way corresponding to the period of incubation of ordinary acute infections, and is in its stage of activity at first essentially a local process. Serum treatment has been shown to be dangerous because of the liability to severe anaphylactic reactions, and is no longer employed in the treatment of pulmonary tuberculosis. It is of interest in this connection that very recently a small number of cases of tuberculous meningitis have recovered after intraspinal injections of antimeningococcus serum. Auto-serotherapy is a term applied to the injection into the tissues of the patient of serum, obtained from his own body from a pleural effusion. The technic consists in the withdrawal of five mils. of the serous effusion from the patient's chest and immediately reinjecting it subcutaneously. The injections thus made are repeated every second day and discontinued when the physical signs of effusion disappear. The success of this treatment, originally suggested for pleural effusion in which the signs of tuberculous disease were not reported, naturally suggested its use in cases in which they were present. Favorable results have been reported in numerous instances, both

in the resorption of the effusion and in the other manifestations of the tuberculous disease. In view of the tendency of serous effusions, most of which are tuberculous, to undergo spontaneous resorption and the remarkable improvement in early cases of pulmonary tuberculosis under proper treatment, the utility of this method of treatment remains to be established by a large number of carefully observed cases.

Autochemotherapy, the subcutaneous injection of the patient's own blood, is another suggestion, the utility of which awaits confirmation.

Artificial Pneumothorax.—Early cases in which the lesions are unilateral may be treated by the immobilization of the lung by the introduction of sterile nitrogen, oxygen or filtered air through a hollow needle. It is important to use a special apparatus by which the quantity of gas injected and the intrathoracic pressure can be known. The inflamed organ is kept at rest; the circulation is diminished, and cavities are reduced in size or closed. It is better to introduce a small volume of nitrogen ranging from 300 to 500 cc., at short intervals, than larger amounts at longer periods. By this means the lung is gradually collapsed without the danger of pleural shock, pleural infection, puncture of the lung with gas embolism or cardiac dilatation, accidents which are liable to occur when larger amounts, 1000 cc. or more are introduced at a single injection. Pleural effusion occurs in from 20 to 50 per cent. of the cases, according to the reports of different observers. When the acute symptoms have subsided, the patient experiences, as a rule, a distinct though temporary improvement. The ultimate effect of the effusion depends upon its amount, its course as regards absorption, and its character. Small, transitory effusions, which do not increase the intrapleural pressure and can be detected only by the use of the fluoroscope, the patient being in the erect posture, are common. They usually undergo rapid resorption and the intrapleural inflations should be continued as in the cases in which no effusion has taken place. Larger effusions reaching to the level of the fifth or fourth rib anteriorly are usually attended with fever, pain in the chest and an aggravation of the cough lasting several days. There is little or no displacement of the mediastinum or tendency to a further increase in the amount of fluid. The intrapleural tension is, however, increased and much augmented by further small inflations. It is nevertheless necessary to cautiously continue them in order to prevent expansion of the collapsed lung into the further formation of adhesions. With evidences of displacement of the mediastinum towards the affected side and retraction of the cavity, an increasing intrapleural pressure must be maintained, reaching in some instances 20 to 30 plus m.m. of mercury. In very large serous effusions the simultaneous aspiration of the fluid and introduction of gas becomes necessary, and the operation should be repeated from time to time, as required, until the fluid ceases to reaccumulate, and the collapse of the lung is maintained by the pneumothorax, the intrapleural pressure being held about zero, so long as the displacement of the mediastinum toward the opposite continues. Purulent effusions, whether sterile, tuberculous as the result of rupture of a

tuberculous abscess in the pleural cavity, or infection by virulent pyogenic organisms should be aspirated and replaced by air. Artificial pneumothorax is only available in selected cases, in which the lesions are unilateral and in the early stages of the disease. The subsequent partial expansion of the lung, with the formation of adhesions when permitted to occur, is attended with the danger of the reexpanding or rupture of cavities, new inflammatory activity in the lung, and rapid increase in the progress of the case. It is therefore obvious that the patients should be treated in sanatoria where systematic röntgenologic studies may be made when necessary, and the general treatment appropriate to the individual case thoroughly carried out. Among the contraindications to this surgical procedure are asthma, bilateral pulmonary emphysema, disease of the heart and chronic nephritis. Intestinal and laryngeal tuberculosis and diabetes also render the prospect of relief uncertain. In favorable cases there is usually a remarkable and very prompt improvement. The temperature falls, the pulse-frequency decreases, cough decreases, and expectoration lessens. Bacilli disappear from the sputum. The patient gains in weight and strength. This favorable change does not invariably occur at once, but even in the exceptional cases it may be expected after a few inflations at intervals of several days. The treatment must be repeated at intervals to be determined by the study of individual cases for a period of several months; sometimes for a year or more. The ultimate anatomical condition of the lung consists in a marked decrease in size, pleural thickening, more or less collapse of cavities, and some atelectasis of the non-tuberculous portion of the lung. The resulting fibrosis varies in amount, but in many cases some degree of expansibility of lung tissue persists.

Heliotherapy.—With a carefully developed technic as used by Rollin of Leysin, upon a great number of patients, this form of radiant light and heat treatment has been remarkably successful in the management of tuberculosis of the bones, joints, lymphatic glands, and serous membranes, and has recently attracted wide attention. The essential natural requirements are a high elevation, a dry equable climate, and the uniform prevalence of unclouded sunlight. Artificial modifications consist in the employment of the quartz lamp or the Hewitt light, and have been used with some success. The plan is an effort to standardize, control and apply for medical purposes an element in the high altitude open-air treatment of tuberculous diseases long recognized as of great importance. To what extent it may prove useful in the pulmonary types of the disease remains to be determined.

Röntgenotherapy.—Among the newer methods directed against the cause, the effect of this measure of treatment in tuberculosis is now being subjected to systematic laboratory and clinical investigation. Such a course is justified by the successful use of the X-rays in a wide field of morbid conditions, especially since the dangers have been much reduced by accurate measurement and control of their penetration and dosage. The experiments upon the laboratory animals have yielded conflicting results, but the

reports from some of the larger clinics, where the plan has been on trial, both in Europe and this country, are favorable. The X-rays are being used by some clinicians in combination with the treatment by the quartz lamp; by others with static electricity. The employment of agents such as these is not unattended by danger, and should not be undertaken by persons who are untrained in their technic and not familiar with their action. Should it prove, hereafter, that their effects are as favorable as is now hoped, they will be extremely useful additions to our present hygienic methods of treatment, but cannot wholly replace them.

Forced Feeding.—As a plan of treatment designed to improve the nutrition, the administration of excessive amounts of food has failed. The method of Debove, which consists in washing out the stomach with cold water and administering through the tube, a mixture made up of a liter of milk, an egg, and 100 grams of powdered meat three times a day; the zomotherapy of Philip—half a pound of raw meat minced, or taken in soup three times a day in addition to other food; and the more recent and even more objectionable plan of two or three quarts of milk, a pint of cream, together with eight or ten raw eggs a day have fortunately been abandoned. No longer do unhappy patients make daily visits to slaughter houses to drink glassfuls of warm blood flowing from arteries of butchered animals.

The Convalescent Patient.—It is in any case difficult to say when convalescence begins. When the cough has ceased except a little in the morning on rising; when upon repeated examinations, the slight expectoration accompanying it no longer contains tubercle bacilli; when the patient is afebrile, has regained his normal weight and is able to take his accustomed former exercise without shortness of breath or fatigue, he has entered upon convalescence. An occasional dry r le at an apex may be disregarded. In a few weeks he may gradually and very cautiously resume his usual occupation. If he has been treated in a sanatorium he can be discharged; if at home, the routine of treatment and long hours of rest may be relaxed. In either case he must be instructed to report to his physician for examination at reasonable intervals, and immediately upon the occurrence of symptoms. Unusual fatigue or lassitude, cough and increased expectoration, shortness of breath, loss of weight, an evening temperature running up to 100  F. or more, and blood-spitting, however slight, are danger signals and require immediate attention. It is much easier to attain a degree of improvement in the incipient and moderately advanced cases that will enable the patient to return to a fairly active life than it is to maintain it. The disease has been arrested, but in patients who have been ill enough to come under treatment, it can rarely be said to be cured. The saying "once tuberculous, always tuberculous" is true. The *motive* of the convalescent is to hold fast to the improved nutrition by which his illness has been arrested; to avoid all hazards; to forego old pleasures and excitement, and as he made a business of getting well, to also make a business of *keeping* well; a more difficult undertaking since his general condition has suffered some impairment by the

ordeal of his illness and he carries in his person the lesions, quiescent, but not always safely or permanently healed.

In the more advanced cases the improvement attained by treatment is not so great, and an arrest of the progress of the disease cannot be spoken of with confidence. The signs of the more or less extensive lesions persist and the symptoms though modified are constantly tending to recur. In either case the lessons learned by systematic treatment are useful and important, long hours of rest, pure fresh air, day and night, carefully regulated diet, the avoidance of excitement, fatigue and if possible, the annoyance of worry. These are the patients who, if circumstances warrant it, are more comfortable in a well selected climate, far from the cares of business and the unfavorable conditions of city life.

Treatment of Acute Miliary Tuberculosis.

There are three clinical forms: (a) The general or so-called typhoid, characterized by the symptoms of an acute general infection; (b) the pulmonary, in which the symptoms are chiefly referable to the lungs and (c) tuberculous meningitis.

Notwithstanding the fact that recovery from acute miliary tuberculosis has been reported in a few instances, the statement has until recently been fully warranted that in all three of the forms the prognosis is fatal. This conclusion has rested upon the nature of the lesions, the severity of the symptoms, and the futility of treatment. It has therefore been assumed that in the few favorable cases hitherto reported the diagnosis may have been at fault. The reader is referred to the subject of the differential diagnosis under the appropriate heading in Vol. II. The resemblance of the generalized form to some cases of atypical enteric fever is very great; that of the pulmonary form to pneumonia or bronchopneumonia is such that in some cases the differentiation cannot immediately be made, and while the diagnosis in the cerebral form is less difficult, it may for a time remain uncertain, especially in children in whom the mode of onset frequently suggests the fulminant type of an acute exanthematous disease. With modern methods of diagnosis all uncertainty speedily disappears; though the fact that the lesions of basilar meningitis and enteric fever have been recognized at the same time, on autopsy, is not to be overlooked. For these reasons energetic symptomatic treatment should be instituted. A diet suitable to the febrile state; water freely; tepid sponging; warm baths; abundant fresh air; sedatives such as dionin or the derivatives of opium if necessary to allay excitement or jactitation; calomel or saline purgation, are among the measures at our command.

Hollis and Pardee in an article in the Archives of Internal Medicine, July, 1920, report the recovery of four cases of meningitis, two of probable but not demonstrated tuberculous nature, and two in which the clinical course, the cell count and differential of the spinal fluid, the finding of tubercle bacilli, and the demonstration of the disease in an inoculated guinea-pig definitely fixed the diagnosis.

intraspinal injections of antimeningococcus serum combined with frequent spinal drainage.

The Treatment of Tuberculosis of the Lymphatic System.—The wide distribution of lymphoid tissue throughout the body and its abundant massing in the form of lymphatic vessels and nodes in relation with the respiratory and digestive tracts acquire a singular importance in the study of the portals of entrance and the distribution of invading organisms. It is in their functions of the arrest and destruction of these agents that the lymph-nodes become the region of detention of tubercle bacilli and the lymph-vessels the paths by which they are transmitted to other organs. Many bacilli undergo destruction; others remain in a viable condition for an indefinite period and, when the tissue in which they are detained fail as barriers, are capable of causing tuberculous lesions in structures and organs to which they are borne; while others still give rise to characteristic lesions in the lymph-nodes themselves, often sparing, for a long time or altogether, other organs to which these are tributary by efferent vessels or the blood stream. It follows that, the tubercle bacillus being distributed wherever there are cases of pulmonary tuberculosis or infected milch kine, the implantation commonly takes place during childhood and that tuberculosis later in life is the result of the lighting up of a long quiescent focus. This theory is supported by fact that about one-third of the cases before the age of puberty are caused by the bovine bacillus. But the necessary close and constant contact between young children and older persons exposes them no less to the danger of the implantation of human bacilli.

Tuberculosis of the lymph-nodes—the *Scrofula* or *Struma* of the older writers, involves the tracheo-bronchial glands most frequently, the cervical groups next in order, the mesenteric and other lymphatic glands less commonly. Finally the serous membranes, pleura, pericardium and peritoneum frequently suffer from the implantation of the bacilli and the resulting tuberculous inflammation.

The anatomical unit, the miliary tubercle is caused singly or in clusters. Degeneration results in the form of coagulation necrosis, the detritus of which, containing tubercle bacilli, may be borne by direct extension to adjacent tissues or to distant parts by the lymph or blood-vessels. The lymph-nodes are involved singly or in chains or groups which usually coalesce and become, when superficially situated, adherent to the overlying skin, ultimately giving rise to abscess formation and sinuses which continue for a long time to discharge. This process of degeneration is accompanied by the formation of dense masses of connective tissue, encapsulating the nodes and resulting, as they slowly heal, in disfiguring cicatrices. In other situations, the course of the lesions is similar, being influenced, however, by the local surroundings. Tubercle bacilli are rarely found in the pus, though present in the caseous detritus and adjacent tissues. In a large proportion of the cases, the tuberculous process is restricted to the group or chain of nodes first affected, and is essentially chronic, tending to limitation and ultimate healing by natural means. The invading bacilli usually find

access to these structures by way of lesions in the mucosa, such as result from catarrhal inflammation in the throat or nose, particularly after measles, whooping cough or diphtheria; or in the gastro-intestinal mucous membrane occurring in the course of the inflammatory affections so common in early life. In a preponderance of instances, however, they appear to penetrate an unbroken membrane. Primary tuberculosis of the upper air passages or the gastro-intestinal tract is of infrequent occurrence. The frequent infection of the larynx and the not uncommon implication of the intestines mostly occur in the later stages of pulmonary tuberculosis, of which they are secondary manifestations.

Preventive Treatment.—General Prophylaxis.—The same measures for the care of the sputum of patients and the protection of the public against milk from tuberculous cows enter into the safeguarding of children. The immunity, which to a great extent protects the adult, appears to be almost or completely lacking in the young child. It is, therefore, of the first importance that the general preventive treatment of tuberculosis must be made operative at that period of human life in which the liability to infection is greatest, and the remote consequences in the spread of the disease are most disastrous. To this end it is for those having knowledge to make known to the people the facts about tuberculosis; to insist upon the enactment of suitable laws, the teaching in the schools, the establishment of social customs, the practice of personal habits, which will give to the child its birthright of protection.

Personal Prophylaxis.—The proper measures for the protection of the infant are attended with hardships. It should be removed from tuberculous parents, especially from the care of the mother if her disease is advanced. Close contact with the members of the household suffering from tuberculosis must be prevented. Existing directions in regard to the disinfection of the sputum and the cleanliness of the surroundings of any patient in the house must be carried out with redoubled care. The nutrition of the individual is so large a factor in the resistance to infection that the best hygienic conditions must be maintained in regard to the living and sleeping rooms, the daily life, the diet, bathing and out-of-doors hours of infants and little children. The milk must be known to be sterile, and if there is any doubt as to the possible presence of bacilli of the bovine type, it must be pasteurized or boiled directly before being used. To avoid risk of dust-borne bacilli, the furniture of the nursery and sleeping-room must be of the simplest kind, without draperies or carpet. As children grow older, such close supervision and protection become impossible, but the theory now generally accepted is that if disease-producing implantation can be prevented in the period of great susceptibility, the subsequent invasion of tubercle bacilli in quantity or virulence incapable of causing tuberculosis but remaining quiescent in the tissue may tend to establish the immunity which exists in a large proportion of adults.

Expectant Treatment.—Chronicity and a sluggish tendency to heal characterize many of the cases of tuberculosis of the lymphatic structures.

Whether these peculiarities are the outcome of an infection in early life by bovine bacilli has not been fully established. To develop these peculiar features in the natural history of this type of tuberculosis by well-directed dietetic and hygienic measures, without the employment of drugs or other remedial agencies, constitutes a form of expectancy which is frequently crowned with success. This treatment in the milder cases may be conducted in the home of the patient under the supervision of his physician. In the more severe forms in which impairment of the general health is greater, and the resistance feeble, sanatorium treatment is desirable. This may be obtained in a preventorium, where the discipline is not trying to the youthful patient and in which the association with patients who are actually ill does not occur; or it may be carried out in a favorable climate in a private home. Sea air is better for this purpose than that of the mountains. The principles of treatment are well-regulated rest and exercise in the open air, a carefully arranged diet in which fruits and fresh vegetables, with milk and milk fats abound, and amusements which are not fatiguing.

The Treatment of Symptoms.—**Tracheobronchial Glands.**—The early symptoms of infection of the tracheobronchial glands are not distinctive. Languor, quickly oncoming fatigue, restlessness and irritability, loss of appetite, impaired nutrition and pallor, occurring after an attack of measles or whooping cough, or in the absence of any substantive disease may attract attention. In the course of time pressure symptoms, substernal pain, dyspnoea upon exertion, and an irritative cough are very suggestive. There may be some difficulty in swallowing. Physical signs of the presence of enlargement of the lymph-nodes now appear. Light percussion over the upper dorsal vertebræ may reveal slight increase of dulness which extends laterally and is sometimes accompanied with demonstrable impairment of resonance at the sternal borders, and upon auscultation by feeble bronchovesicular respiration and a faint venous hum in the corresponding area. These signs may be confirmed by stereoscopic röntgenograms. In many of the cases palpation discovers some enlargement of the deep cervical or axillary nodes. The slight elevations of temperature which, in the absence of other obvious causes, characterize early tuberculous infection elsewhere in the body are observed. These clinical manifestations in favorable cases gradually pass into a chronic condition and subside in intensity and the child as it grows up presents the appearance of delicate health without the positive symptoms of disease, characteristic of the so-called pretuberculosis stage.

Cervical Glands.—The submaxillary and deep cervical groups are commonly involved. The process is chronic with occasional exacerbations attended with mild fever. The usual period of life is infancy and early childhood, but tuberculous adenitis of the superficial lymph-nodes may occur occasionally later, even in the adult. One side is commonly affected. The nodes are slightly enlarged, somewhat tender and freely movable. Calcareous and fibrotic changes take place, sometimes as early terminal conditions, oftener as processes of the degeneration peculiar to tuberculous

tissues, with periods of advance alternating with quiescence, adhesions among the adjacent nodules and skin being formed with ultimate softening and sinus formation.

Mesenteric and Retroperitoneal Glands.—*Tabes Mesenterica* of the earlier writers is a localization of tuberculosis common in little children but sometimes encountered in adults. When the bacilli causing it are arrested, the glandular lesions are essentially the same as in other lymph-nodes and pursue a similar course sometimes to fibrotic and calcareous changes, sometimes to necrosis and softening. In the former instance, the condition may not be recognized during life as it is not the occasion of local symptoms but rather of impaired nutrition and lowered general health. In the latter case grave symptoms arise which are due to the extension of the infection in various directions among the abdominal viscera—diarrhœa, difficulty of control, tympanites, tenderness, a doughy sensation on palpation with irregular nodular formation and pressure symptoms, irregularly distributed, ascites, œdema of the feet, enlargement of the superficial abdominal veins and stubborn constipation alternating with watery looseness of the bowels. Fever, emaciation and progressive exhaustion close the scene.

Involvement of the Lymphatic Glands.—Other lymph-nodes in various parts of the body may become tuberculous, the local lesions and general symptoms depending upon the situation of the glands, the changes which the agglomerated tubercles undergo—whether caseation, which is destructive, or fibrotic, which is conservative, the extent and intensity of the inflammatory process and the degree of involvement of the tissues and organs to which the efferent lymph-channels are tributary.

Generalized Tuberculous Lymphadenitis.—Cases have been reported characterized by involvement of the tracheo-bronchial, mesenteric and retroperitoneal group, at or about the same time, and sometimes also of the superficial glands, continuous high fever of irregular type, and little or no evidence of tuberculous disease in other organs. This type begins acutely and runs a rapidly fatal course. It appears to be more common in negroes. When the cervical, axillary and inguinal groups are involved, the resemblance to Hodgkin's disease is very close. A form of generalized tuberculosis occurs in young children in which the various groups of glands are successively implicated.

Tuberculosis of the Serous Membranes.—The pleura, pericardium and peritoneum are very commonly the seat of tuberculous inflammation, which is usually secondary to tuberculous organs or lymph-nodes, though such a primary cause may not always be discovered. It may be acute and run the course of a severe and often fatal disease or subacute, with slowly developing exudate, ulceration and softening; or the inflammatory type may be chronic with connective tissue formation, thickening adhesions and fibrotic, rather than exudative changes. The pleuræ are most commonly involved and a very large proportion of all pleurisies, whether dry, sero-fibrinous, purulent, or hæmorrhagic are tuberculous. Next in order of frequency is tuberculous peritonitis and less frequent is the implication of the pericar-

dium. The last is in many instances unrecognized during life or attended with effusion, the nature of which, in the absence of the signs of tuberculosis elsewhere, often remains unsuspected.

The foregoing paragraphs have been written with the view of placing the indications for the treatment of symptoms clearly before the reader. If that design has been successfully carried out, it would be a needless repetition to again set forth in detail the therapeutic measures; suffice it to say that, in referring to the pages devoted to this subject under the appropriate heading in the general discussion of the treatment of pulmonary tuberculosis, many of the means by which symptoms may be relieved will be found. The essential unity of tuberculosis as a process in its many manifestations tends to simplify our conceptions in regard to its therapy; and while the treatment of symptoms is often expedient and frequently necessary, the methods which experience has proved most useful when directed against the cause are, in a majority of instances, those most satisfactory in the alleviation of the symptoms, and this is particularly so in regard to tuberculosis of the lymphatic system.

The Causal Treatment of Tuberculosis of the Lymphatic System.—

The establishment and maintenance of the highest degree of health normal to the individual and thus to increase the resistance of his tissues against the invading organisms, constitutes the most important measure of treatment against the cause of lymphatic tuberculosis as in the other types of the disease. The manner in which this may be accomplished has been briefly described under the head "Expectant Treatment."

Drug Treatment.—In little children two remedial agents of value are cod liver oil and iodine. The former in a properly made emulsion, freshly prepared at short intervals, is readily taken and well borne. The percentage of oil may be varied to suit the individual child. This substance has not only a food value but it also possesses a specific antirachitic content of unquestioned importance in childhood. Iodine in the form of the syrup of iodide of iron, syrup of hydriodic acid, or some of the proprietary preparations, in small doses for long periods, or with cod liver oil in alternating courses, has a distinctly favorable influence.

Specific Therapy.—It is especially in this form of tuberculosis that forms of tuberculin have shown their value. The carefully regulated administration of this substance by those experienced in the technic in selected cases, particularly in disease of the glands, has apparently yielded remarkably good results. In this connection it is well to bear in mind the tendency to a natural healing and obsolescence characteristic of this type of the disease.

Heliotherapy.—Tuberculosis of the lymphatic system must be placed along with tuberculosis of the joints, bones, and serous membrane in the large group of cases in which the regulated systematic employment of solar light and heat or the artificial substitutes for these agents has been in recent years very efficacious.

Surgery.—The early removal of tuberculous cervical lymph-nodes

• which show a tendency to resist medical treatment is to be strongly recommended. The operation should be thorough and the entire group or chain involved effectually extirpated. By this means, in favorable cases, the danger of extension to other organs, especially the lungs, is minimized; a protracted, disfiguring and troublesome local disease relieved; and ultimate recovery obtained without unsightly scarring, in a percentage of cases varying from 75 to 90 per cent. In less favorable cases, in which necrosis and softening has already taken place, much benefit may follow surgical intervention in the removal of diseased tissue, the establishment of drainage, and the prevention to some extent of the formation of conspicuous cicatrices. If every case of cervical adenitis is given prompt attention, alike from the standpoint of diagnosis and treatment, medical measures will prove efficient even in a considerable percentage of the tuberculous cases, and operative procedures will be rendered unnecessary.

XXXII. SYPHILIS.

SAMUEL BRADBURY.

• Syphilis is definitely an infectious disease. Its distribution is at present perhaps wider than that of tuberculosis, but the taboo of the present social organization forbids that it be made a reportable disease. Society countenances free exposure, even at times claiming that this is necessary to health, but condemns, when he is known, the unfortunate who contracts syphilis. Its consequences are worse than those of tuberculosis, not only because the uncured male transmits his infection to a wife and dreadfully handicaps children, but because, after years of latency, he may be struck down to helpless invalidism when his life is needed for his dependants. Often he and they are thereafter supported by the charity of the state. It has been estimated that 10,000,000 of the population of the United States is syphilitic. Williams estimated that of the 12,000 annual admissions to the State Insane Hospitals of New York, Massachusetts and Ohio, those having syphilitic mental disease number about 1,500 (12.7 per cent.). Syphilis is a state problem; its present cost is prohibitive; its total eradication may be hoped for, and medicine is perhaps better fitted in the knowledge of syphilis to eliminate it than any other infectious disease.

• **Prevention.**—Any discussion of the prevention of syphilis must deal with the problem of prostitution, which is its principal disseminator. Many intelligent and earnest workers have spent years in efforts at effecting some method for the control of this social leech, but the customs of civilization still countenance promiscuous intercourse, and only slow years of general education can work changes in such deeply-rooted usages. The usual result of laws has been to encourage clandestine practices, and most acknowledge that the clandestine prostitute is the most dangerous disseminator of disease. As Osler says, "Resisting all attempts at solution, the social evil remains the great blot upon our civilization, and inextricably blended with it, is the question of the prevention of syphilis."

There are a number of other phases of the problem of the prevention of syphilis which belong also to the state. It would appear desirable to make it compulsory to report cases of syphilis, and to exercise some sort of control over them, as is done with other infectious diseases. This would work a great hardship upon the patient, which in itself would be a relatively small matter, but the fear of exposure would inevitably drive the individual who suspected syphilis in himself to concealment of the disease, and either self-medication or treatment at the hands of some charlatan. Insisting that the applicants for a license to marry produce certificates of health, or undergo physical examination and a Wassermann test, might assist in driving home a knowledge of the consequences that may follow when the syphilitic raises a family. One difficulty is that the knowledge is then too late. It seems strange that in the present day any one can be ignorant of the dangers of the common drinking cup, yet in many places common sense precautions with regard to this and kindred articles are totally neglected. Bulkley collected 9,058 instances of extragenital infection. Twenty per cent. were upon the lips, 12.5 per cent. on the breast, 5 per cent. were upon the hands and the remainder scattered, scarcely a part of the body escaping. The effect of the prohibition of alcoholic drinks upon the incidence of syphilis will not be apparent for some years. It has been claimed that promiscuity in the sexual relation will increase with prohibition; but without alcohol men will not cohabit so indiscriminately, and can better carry out preventive measures afterward. Certainly the man who risks his life or eyesight upon the liquor now offered is made less intelligent than before. Each patient cured of syphilis, or, in the early stages made rapidly non-infectious, reduces the incidence of syphilis. For this reason, the recent educational effort of the United States Public Health Service, and their establishment of dispensaries where individuals infected may be advised and properly treated at cost, or for nothing if necessary, is a step in the right direction. The physician should support this work, for it puts the treatment of syphilis, for the patient of small means, into competent hands, and will help drive out the charlatan who has fattened upon venereal disease. Most states have made laws which provide for the hygiene of barber shops, chiropodists and midwives, and New York City insists upon the examination of the food handlers.

The individual physician approaches the problem of the prevention of syphilis more closely in counsel to his clients on how the disease may be avoided, and, if contracted, how others with whom the patient is associated, may best be protected.

Personal Prevention.—It is generally agreed that continence is not detrimental to health, and plainly continence is the best preventive of syphilis. It may be extremely difficult to practise, but a physically clean body and a mental absorption in the day's work make it easier. Continence was urged upon the Army during the Great War in no uncertain terms.

If an individual must practise promiscuous coitus, the physician should examine the external genitalia to make sure that they may be adequately

cleansed at all times. A phimotic or redundant prepuce should be amputated, and the patient should be instructed to keep the penis clean and free from irritation.

The Army experience further pointed out the great value of the medicinal prophylaxis of venereal disease. After exposure to such diseases, and intercourse with any prostitute is exposure, the penis, scrotum and suprapubic regions are thoroughly washed with soap and water. Reasoner found that soap suds would promptly kill *spirochæta pallida* and the Army found that the soap and water cleansing was as effective as any other measure against chancroidal infection. After drying, a solution of one of the albuminates of silver was injected into the urethra and held there, by pinching together the meatus, for five minutes. Then the penis, scrotum and suprapubic regions were carefully anointed with 33 per cent. calomel ointment in lanolin, or with the mercury ointment of the Pharmacopœia, paying especial attention to the glans penis. The ointment should then be covered with a paper napkin, or the underclothes may be worn and it left on all night. Metchnikoff and Roux found that mercurial ointment, applied within eighteen hours after infection, would prevent syphilis in most cases. In the Army a much shorter time between exposure and prophylaxis was insisted upon to prevent the development of gonorrhœa, and it was found that with prophylactic treatment given within three hours, practically no man developed venereal disease. The factors most culpable in the infection of the soldier were alcohol and the overnight leave. A condom may be worn during intercourse but prophylactic treatment should be carried out as rigorously as without such protection.

For the female, prophylactic treatment cannot be as effective because of the extent and inaccessibility of the exposed parts. A 1 to 1000 solution of bichloride of mercury wash has been advised, but this remedy may only be placed in the hands of intelligent women. Numerous cases of general poisoning have arisen because of carelessness in dissolving the tablets, or even inserting them, undissolved, into the vagina.

Schamberg has advised the injection of neoparsphenamin in women after known exposure to active syphilis, such as the wives of men with a chancre. One or two injections are administered at intervals of one week, the husband meanwhile being treated.

The Patient.—The early diagnosis now possible by examination for the *spirochæta pallida*, and the practicability of so rapidly rendering the patient non-infectious have materially lessened the danger of transmission of syphilis during the active early stages. This should not however lessen the necessity for the careful instruction of the active case as to how to avoid infecting others. The chancre or condylomata about the external genitalia, and the mucous patches in the mouth are the lesions of greatest infectivity, but any open sore during any stage of the disease is to be regarded as dangerous. Coitus must not be practised; the patient must not kiss others; and glasses, cups, tableware, toothpicks, pipes, cigars, and cigarettes may all carry the organism. Careful washing of the tableware and glasses with

hot water and soap sufficiently sterilizes them. Other articles should be burned after use. The patient should have his own towel, razor, soap, brushes and comb, and it is best if he have a separate bath room. The underclothing should be disinfected before being placed in the general laundry. Dressings used to protect any open sore should be burned. Many syphilitics appear to feel that they are pariahs and, like such members of society, have a supreme disregard for the safety of others.

Marriage.—The physician must, if possible, prevent marriage until every chance of infecting the partner to the union has passed. It is extremely difficult to determine what this period is in all cases and only general rules may be laid down. At least three full years should have passed since the initial lesion; the treatment should have been thorough; there should have been no clinical evidence of the disease for two years, and the Wassermann reaction should have been *persistently* negative for a year. The physician cannot afford to be careless in this respect, for an uncured infection may appear in the progeny.

PREVENTION OF HEREDITARY SYPHILIS.—The syphilitic prospective mother may be so treated that she will bear a healthy child. It is necessary that treatment be started early in the pregnancy, before the fifth month, as later treatment is of little value. Mercury is the drug usually chosen, and the dose should be that ordinarily used. Early in the pregnancy a course of five or six injections of arsphenamin may be given, to be followed by the administration, until term, of mercury by injection or orally. The physician may be considerably handicapped in the treatment of such cases when it is necessary to keep the mother in ignorance of the disease with which she is infected.

Treatment of Syphilis.—The discovery of the causative organism *spirochæta pallida*, by Schaudinn, of a diagnostic laboratory procedure by Wassermann, and of an arsenic derivative of great value in the treatment by Ehrlich, have broadened our knowledge and greatly strengthened the measures which may be utilized for combating the inroads of this disease. It should at once be fully understood that syphilis is a chronic general disease, and that the longer the time it has existed in the body without treatment the more profound is its dissemination and the more difficult is its eradication. The organism has the faculty of lying apparently dormant in vital organs for years, and of then appearing symptomatically and, within a few months or years, rendering its victim helpless.

When treatment is started during the primary or early secondary stages, a cure is possible in most cases; started late, cure is much more difficult or impossible, and damage done by the infection is irreparable. In any stage every factor which will assist in the eradication of the disease must be brought into play, and the physician should remember that the general health of the patient and the hygiene which assists healthy living are important adjuncts in the treatment. Habits of sleep, work, exercise and recreation, should be reviewed and adjusted where they are unhygienic. Abnormal mouth, teeth, and digestive tract, and the eating habits should

be corrected. Coitus is best prohibited. Alcohol is harmful in that it throws more work upon the stomach, liver and kidneys; and tobacco should be given up because it is irritating to the mouth, tongue and throat. The condition of the organs of elimination, especially the kidneys, should be examined into and, if found defective, care must be taken that too great strain is not thrown upon them. The bowels should be kept open and the skin kept clean and active.

Fortunately for the treatment of syphilis we have two drugs which are actively spirochæticidal—mercury, and arsphenamin and its derivatives. Iodine is not spirochæticidal but long years of experience testify to its great value as accessory to the active drugs. In early cases the administration of arsphenamin or of both drugs should be started as soon as a positive diagnosis of syphilis has been made.

Mercury.—Mercury in one form or another has been used in the treatment of syphilis for centuries. Its administration in long continued dosage appears to be necessary for a cure, no matter what other medication may have been used. The dose of any preparation should be as much as the patient can take over long periods of time without detriment to the general health. The size of these doses must be determined for each individual, no matter by what route the drug may be administered.

Mercury is actively parasitropic but the range between the effective therapeutic dose and the poisonous dose is not so wide as that of arsphenamin. The kidney and the brain are especially vulnerable to mercury (Schamberg), and in any method of administration, the urine, as indicative of its effect upon the kidneys, should be closely watched.

In the case of syphilis which is under treatment by mercury, the mouth and teeth must be kept exceptionally clean. The amount of mercury which is taken may be controlled by this factor, as, with dirty teeth, gingivitis may result from such small doses that no therapeutic effect upon the disease results. The teeth should be brushed carefully after each meal, using a soft brush upon which are four or five drops of tincture of myrrh. When there are open lesions in the mouth the application of ten per cent. silver nitrate solution, once daily, is most efficacious.

Every patient receiving mercury should be instructed as to the signs of overdosage, especially of soreness of the gums or looseness of the bowels. There may be also fetor of the breath, increased and ropy saliva, irritation of the gum margins, and soreness of the teeth in biting. If these symptoms occur, mercury should be stopped and measures designed to eliminate the drug instituted. The water intake should be increased, a hot bath or a Turkish bath should be taken every day, and the bowels should be opened daily by salines. Rarely, after long continued administration of mercury, a polyneuritis or the usual tremor and erythema of other forms of chronic mercury poisoning are seen, and can be met only by absolute withdrawal of the drug.

Mercury has been given by numerous methods but those which have proven most effective and are in most widespread use are the oral admin-

istration, the inunction, and hypodermic injection, usually intramuscular, occasionally intravenous. A great deal of work has been done in the attempt to produce a compound of mercury which will have a higher therapeutic index, *i.e.* a wider divergence between the parasitropic and the organotropic dose, but no better preparation has so far been brought forward than those which have been in common use for a number of years.

Oral Administration.—Years of experience in the oral administration of various preparations of mercury have proven that this method has a valuable place in the treatment of syphilis. It is effective, convenient, inexpensive, and least troublesome to the patient. Its disadvantages are that the case is not under as good control, the dosage is not as exact, and absorption from the intestinal tract may be irregular. Either compressed tablets or a liquid preparation may be used.

The most frequently used tablet preparations are the protiodide (*hydrargyri iodidum flavum*) in doses of 0.01 to 0.02 gram ($\frac{1}{6}$ to $\frac{1}{3}$ grain) three times daily, and mercury with chalk (*hydrargyrum cum creta*) in doses of 0.065 to 0.13 gram (1 to 2 grains) thrice daily.

For a liquid preparation the bichloride of mercury in doses of 0.001 to 0.003 gram ($\frac{1}{60}$ to $\frac{1}{20}$ grain) three times daily is best. It is usually dissolved in *syrupus sarsaparillæ compositus* or *elixir cinchonæ*, and, when mercury is given by mouth late in the disease, potassium iodide may be added to the mixture.

Inunction.—The advantages of the administration of mercury by inunction are that it is fully efficient and that it may be discontinued upon the first sign of overdosage. The great disadvantage is that it is dirty. It is also difficult to conceal, and in a few patients, will cause a severe local inflammation of the skin. The preparation used is the official *unguentum hydrargyri* (50 per cent. strength). The part to be rubbed should be non-hairy and thin skinned, and, if the rubbing be done by the patient, accessible parts of the body must be chosen, such as the sides of the abdomen, the flexor surfaces of the arms and forearms, and the inner sides of the thighs. Rubbing must be continued until the ointment has nearly disappeared. Woollen underclothing may be worn over the ointment all night, and the remainder may be washed off in the morning. The areas for rubbing are used in rotation, one each night, and 30 to 45 rubbings are given.

Schamberg, and his co-workers, upon the basis of animal experimentation, advise an ointment of calomel in place of the official mercury ointment. They found that it would fatally poison rabbits in amounts comparable to the mercury ointment. They advise a mixture of 3.0 grams (45 grains) of calomel, 1 gram (15 grains) of lanolin, and benzoinated lard 2.0 grams (30 grains), the amounts as given to constitute one dose.

Injection.—Mercury may be injected by the hypodermic syringe either into the muscles or into a vein. For the former, intramuscular injection, either the soluble or insoluble salts may be used. For intravenous injection only the soluble salts of mercury, such as cyanide, succinimide and bichloride can be used, and are more valuable when a rapid action is de-

sired. The drug must be injected daily or every other day. The bichloride should be dissolved in normal saline; the other two may be dissolved in water. The dose of the bichloride and of the cyanide is 0.008 to 0.015 gram ($\frac{1}{8}$ to $\frac{1}{4}$ grain) while the dose of the succinimide is 0.02 gram ($\frac{1}{3}$ grain).

Injections into the veins are likely to cause a low grade phlebitis, which will in time obliterate the vessel. It is said that this difficulty is prevented by first withdrawing into the syringe 3 to 5 cc. (about 1 dram) of blood, and then reinjecting the mixed blood and solution of the drug.

Insoluble preparations are more convenient to the patient in that he reports but once weekly. The suspension of mercury is made in some oily substance which is liquid at body heat. The best fatty substance as a vehicle for intramuscular injections is palmitin, but olive oil or cocoanut oil may be used. The injection is made into the buttock muscles through a needle of about eighteen gauge and about one and one-half inches long, first being sure that a vein has not been entered. The method is ideal in one respect, in that there is constant slow absorption of the drug extending over 4 to 7 days. The disadvantages are that the injection and the resulting mass are often painful; that pytalism may begin when a newly injected dose has not nearly been absorbed, necessitating the cutting down upon and evacuating the most recent dose; and the occasional production of a painful nodule, an abscess, or an embolus owing to injection of the drug into a vein.

The best compound for intramuscular use is the salicylate of mercury, the suspension being so made that there is 0.065 gram (1 grain) in each cubic centimeter (15 minims), and the weekly dose is 0.065 to 0.13 gram (1 to 2 grains). Gray oil, metallic mercury triturated to a fine suspension in oil, has been used, but it has been recently demonstrated by x-ray studies that it is not absorbed.

Arsphenamin and Its Derivatives.—There are in present use arsphenamin, neoarsphenamin, sodium arsphenamin and silver arsphenamin. The two former drugs are the same as Ehrlich's original preparations, salvarsan and neosalvarsan. They have now been in use for a number of years and their value in the treatment of syphilis has been proven by many observers. The latter drugs, sodium arsphenamin and silver arsphenamin are much newer and their use is still largely experimental. Most reports indicate that they are slower in action and more likely to give reactions than the older preparations, despite the smaller dosage. Scholtz, after an experience of more than a year with silver arsphenamin, comes to the conclusion that it is inferior to the old arsphenamin and not less likely to be followed by severe side effects such as encephalitis, dermatitis and neurorecurrence. A case of argyria has been reported occurring after the twelfth injection of silver arsphenamin. The older drugs are still of inestimable value in the treatment of syphilis and the practitioner would best learn to use them effectively until the value of newer remedies has been more effectively demonstrated.

ARSPHENAMIN.—By requirement of the United States Public Health Laboratories arsphenamin must contain 29 to 31 per cent. of arsenic in

organic combination, and be free of inorganic arsenic. The drug has a high affinity for spirochaetes and a relatively low toxicity, making possible the introduction into the body of between 2 and 3 grains of arsenic in this organic combination when the usual maximum dose is injected.

The effect of arsphenamin upon the early lesions of syphilis is remarkable, some of them healing within 48 hours. The part of the body most liable to damage is the liver, and this liability is greater when there is some lowering of the kidney function. Such accidents are relatively rare, and the relative safety of the drug, when properly made up, is one of its most remarkable properties.

The intravenous injection of a dilute and alkalinized solution is the only way in which arsphenamin is now used. The drug is purchased in ampoules of various sizes, each containing one dose. Before opening, the ampoule should be immersed in alcohol for fifteen minutes to make sure that there are no leaks or cracks, as, if there are, the drug will have oxidized and then becomes toxic.

If no leaks are found the ampoule is wiped dry, the upper part of the neck filed or broken off and the contents sprinkled upon the surface of freshly distilled and sterilized water at room temperature, in a mixing cylinder of 150 cubic centimeters capacity. For solution of arsphenamin there should be twenty cubic centimeters of water for each 0.1 gram of the drug. The mixture is gently shaken until complete solution has taken place, and the resulting liquid should be water clear, yellow. It is strongly acid, would be very toxic if injected, and must be alkalinized. To accomplish this a 15 per cent. solution of chemically pure sodium hydrate is added. About two drops per decigram of drug is added at once and will produce a dense yellow precipitate. Then the sodium hydrate solution is added drop by drop, agitating the vessel after each drop, until a perfectly clear yellow solution results. This should be diluted with freshly distilled sterile water or with 0.5 per cent. saline solution, until there is thirty cubic centimeters of solution for each 0.1 gram of drug used.

The dose of arsphenamin depends upon the size of the patient and upon his physical condition. The first dose is always small. With early syphilis in an otherwise healthy man, the dose is usually one decigram for each thirty pounds of body weight. As a rule, when treating lesions of the vital organs it is best to begin with smaller doses, until the patient's reaction to and tolerance of the drug have been definitely established.

The injection is made into a vein and it should be so timed that it does not flow in faster than at the rate of two minutes for each decigram of drug in the solution, and preferably should be slower than this. The best apparatus is a gravity burette. Great care should be taken that none of the solution leaks into the tissues about the vein, as it is very irritating and, with any amount of leakage, will probably cause necrosis.

• **NEOARSPHENAMIN.**—Neoarsphenamin, according to Schamberg, has a higher therapeutic ratio, *i.e.*, a wider range between the effective therapeutic dose and the toxic dose, than has arsphenamin, and may therefore be

given in larger amounts with less ill effect than the older drug. Neoarsphenamin has about two-thirds the arsenic content of arsphenamin, but its therapeutic activity, according to Schamberg and his co-workers, and to Castelli, is, for an equal weight of the drug, less than two-thirds that of arsphenamin. Schamberg estimates that 1.05 gram of neoarsphenamin more nearly equals 0.6 gram of arsphenamin in therapeutic activity, but for other reasons he prefers neoarsphenamin. The principal reasons for this preference are that the neoarsphenamin is over two and one-half times less toxic for white rats than is arsphenamin when the two drugs are made from the same preparations; that neoarsphenamin in the doses and dilutions ordinarily used is non-hæmolytic, and that its hydrogen-ion content is practically that of the blood. On these grounds Schamberg advises that neoarsphenamin be used in about twice the dosage of arsphenamin. Its great convenience is its easy solubility in water, and that it may be administered in concentrated solution.

Neoarsphenamin oxidizes far more readily than does arsphenamin. It must, therefore, be dissolved in cool water, about 22°C.; it should be made up fresh for each patient and injected at once. The injection is always into a vein, and should be made slowly, consuming five to ten minutes for a full dose.

Schamberg points out that the drug may be dissolved in its own ampoule. The extreme tip of the glass ampoule is broken off, and through this hole the needle is inserted and a few cubic centimetres of sterile freshly distilled water is injected. The ampoule is then gently shaken until solution is complete, when the liquid is again drawn up into the syringe through the needle and, with the addition of a few more cubic centimetres of water, is ready for injection.

REACTIONS AFTER ARSPHENAMIN AND ITS DERIVATIVES.—There are a number of types of reaction, and they may occur during the injection, or some hours or days after the injection of either arsphenamin or neoarsphenamin. In order of frequency these reactions are the vasomotor, gastro-intestinal, skin, and those with symptoms pointing toward liver or brain inflammation.

The Vasomotor Reaction, or nitritoid crisis, usually occurs during or immediately after the injection. The commonest form is marked flushing of the face and perhaps some increase in the rate of respiration. In more severe reactions there are swelling of the lips or tongue, suffusion of the conjunctivæ, and sometimes cough and respiratory distress. Rarely there is a condition which seems like surgical shock, with pallor and pulselessness, and, at times, unconsciousness which may be fatal. The cause is usually considered to be allied to anaphylaxis, but other reasons advanced are an adrenal insufficiency, precipitation of the drug in the blood and some as yet undiscovered impurity of the drug (Schamberg). The treatment is the immediate injection of 0.6 cubic centimeter (10 minims) of 1 to 1000 solution of epinephrin, and the physician should have this drug, and means for

administering it at hand for immediate use, whenever arsphenamin is injected.

Gastro-intestinal Reactions occur usually in two to four hours after injection of arsphenamin. Diarrhœa is the usual complaint, two to four watery stools being evacuated. There may be vomiting, headache, fever or chilliness. These reactions are rarely serious or prolonged. At first they were thought due to the water used in making the solution, but eating too heavily, soon before or after injection, will often cause gastro-intestinal disturbance. At times, the diarrhœa seems like an effort at elimination.

Skin Reactions may occur at any time up to ten days after the drug has been administered. The early reactions are urticarial or erythematous. Purpura has been observed. Late reactions may simulate *dermatitis exfoliativa* and this may be fatal. No more arsenic should be administered; the patient should be put to bed, the bowels kept open, and the kidneys flushed with increased amounts of water.

Jaundice is not rare. A few cases have died with symptoms like those of acute yellow atrophy of the liver, but most will clear up after several weeks. Most observers believe the liver is directly affected by the arsphenamin, sometimes primarily due to deficient renal elimination of the drug. Milian however claims jaundice is due to spirochætal inflammation of the liver and that recovery follows further antiluetic treatment. Schamberg's experiments upon animals, in which he has definitely proved that the liver is directly affected by arsphenamin, should make one cautious about administering more arsphenamin. The few personally observed have cleared up after several weeks without any medication.

Brain Symptoms are the most serious, and brain affections are responsible for most of the fatalities after arsphenamin. Œdema of the brain or hæmorrhagic encephalitis is usually found. In most cases the drug has been administered in too large doses or at too frequent intervals.

In the general prevention of reactions and accidents, following the administration of arsphenamin and its derivatives, it is important always to:

1. Make sure that the drug has not decomposed.
2. Use freshly distilled water, and, in the case of arsphenamin, alkalinize exactly.
3. Use perfectly clean mixing flask, rubber tubing and needles.
4. Give dilute solutions slowly and soon after their preparation.
5. Always have at hand epinephrin and a sterile hypodermic syringe.
6. Do not give the injection soon after a meal; have the patient rest in the recumbent posture for an hour after injection, and warn him that he should eat only a light meal that evening.

The size and interval of dosage will be considered under the routine care of syphilis (page 159).

Iodine.—Iodine is not a spirochæticide, but it is of great value in removing the diseased and necrotic tissues which surround the organisms, and, when mercury or arsphenamin are administered at the same time, the

parasiticide drugs have much better effect. The removal of large masses of diseased tissues, such as gummata, is of great help in restoring function to diseased parts. Iodides probably combine with the unsaturated fatty acid radicals which inhibit hæmolysis.

Potassium iodide is the iodine salt usually preferred, but the sodium iodide may also be used and in some cases is better tolerated. As a rule both are well tolerated by the stomach and absorption from the intestinal tract is quite rapid, so oral administration is quite satisfactory. The drug is usually ordered in saturated solution, the patient being instructed to take the requisite number of drops, each of which is approximately equal to 0.06 gram (1 grain). The dose should be well diluted in water or milk and be taken either during or after meals. The dosage used varies widely, but most syphilographers are opposed to the enormous doses which have been used in the past. At beginning treatment the dose is usually 0.6 gram (10 grains) three times daily, and this is gradually increased, by 0.06 to 0.18 gram (1 to 3 grains) daily, to a dose of 1.0 to 3.0 grams (15 to 45 grains) after each meal. Very large doses may be advisable in rare cases of brain gummata, and then as much as 30 to 60 grams (1 to 2 ounces) daily have been used. In the ordinary case such large doses are not necessary and may be harmful, as smaller doses, continued for long periods, give the best results.

Iodism.—Some individuals have an idiosyncrasy to iodides. Symptoms of its toxic action may appear after but one or two doses and are, in certain instances, quite alarming.

The usual complaints are of coryza and swelling and tenderness of the glands beneath the jaw. Acne is of frequent occurrence appearing after iodides have been taken for some days. A metallic taste in the mouth is often complained of. Less common symptoms of iodism are mild ptyalism, purpura, which appears on the extremities, nausea, vomiting and diarrhœa, and localized œdema. When the latter attacks the larynx, an immediate tracheotomy may be necessary. Rarely, there is a bullous eruption of the skin which may prove to be fatal. With such occurrences the iodides should be withdrawn at once, but after a week or two may be again started in smaller dosage. Potter says "Despite wide acceptance, I have never become convinced of the wisdom of doubling the dose upon the onset of symptoms of iodism; but in many instances a rapid rather than a slow increase in the amount of the drug leads to a more prompt and continued tolerance."

Routine Care.—Recent Infections.—Treatment now, as was the custom formerly, should be started only after a positive diagnosis of syphilis has been made. Since the discovery of the causative organism and the complement fixation reaction as applied to syphilis, it is no longer necessary to wait for the appearance of the secondary stage. When the *spirochæta pallida* is found in chancre or mucous patch, or the Wassermann reaction is positive, specific treatment should be started immediately. Both Wassermann reaction and the search for spirochætes should be done by those who

have had a large experience in these determinations, and such expert diagnostic opinion is now available to most physicians in the United States.

The Chancre.—The initial lesion, before the diagnosis has been made, should be kept clean and dressed with normal salt solution; after spirochaetes have been found it should be dressed with calomel or mercury ointment. If it be in such a location that its excision will cause no deformity, this operation may be done.

Systemic Treatment.—Before the patient is started upon his long course of medication he should be carefully examined. The condition of the liver, kidneys, and vascular system especially must be carefully determined, and when any of these vital organs is defective, treatment must usually be modified to suit their capabilities. No patient should be harmed by intensity of treatment.

There have been numerous suggestions for a routine course of medication which will be sufficient to free the early syphilitic of his infection. There is general agreement upon but one point, that treatment should begin with arsphenamin or one of its derivatives and that repeated injections of this drug should be given at intervals. It is generally agreed, too, that mercury is necessary for a cure. Some advise that it be given during the series of arsphenamin injections, others that it follow the injections of the arsenic preparation.

Patients must vary in their susceptibility and reaction to the infection, and the organism itself must have strains of varying virulency, so that it will probably always be impossible to establish an amount of medication which will unfailingly cure in these early cases. After any treatment the patient must be kept under observation for at least a year, and his blood must be examined at intervals for the Wassermann reaction. If it become again positive, further treatment should be given at once.

During the Great War, the Army authorities, upon the advice of a board of syphilographers, recommended that a series of eight doses of arsphenamin be given, the first three doses at five day intervals, the remaining five injections at intervals of one week. The arsphenamin was to be accompanied or immediately followed (at the choice of the physician) by a series of six to eight weekly injections of an insoluble salt of mercury, or thirty-five to forty-five daily inunctions of mercury ointment. After eight weeks without medication, the entire course was to be repeated, and following this, the patient was to be kept under observation for a year, and a Wassermann test to be done once each month. If the patient upon whom treatment was started in the early stages remained free of all clinical evidence of syphilis, and the Wassermann reaction remained negative during this year, he was discharged from observation. The entire period of treatment and of observation, provided there was no recurrence of symptoms or of a positive Wassermann reaction, would thus cover a year and a half. Such a course of treatment will, in the great majority of cases of recent syphilis, assure a cure. There are several minor points which may be mentioned. It is best to give an amount of arsphenamin on the first dose, which is about one-half

that given the healthy young adult, or between 0.25 to 0.35 gram (0.4 to 0.6 nearsphenamin). If he is found to take the drug well, the full dose, 0.1 gram arsphenamin (0.2 nearsphenamin) for each thirty pounds of body weight, may be injected thereafter. The urine should be examined before and after each injection of arsphenamin to determine if there is any untoward effect upon the kidney. A trace of albumin and a few casts may be expected on the day following an injection. Before each injection the patient should be examined and questioned to make sure that he has no ill effect from the previous dose. The question of whether mercury should be given during or following the course of arsphenamin is a difficult one. If there be any kidney disability it is certainly best to administer mercury after the course of arsphenamin. It appears that mercury affects the kidney chiefly, and that, if these drugs be given alternately at short intervals, kidney excretion may be so lowered that the arsphenamin is not properly eliminated, and oxidizes in the body.

Schamberg does not give mercury during the course of arsphenamin in any patient, and he has seen but three cases of liver disturbance in 12,000 injections of arsphenamin.

Treatment of Old Infections.—The syphilitic who has had his infection for a number of years usually presents himself complaining of symptoms which denote abnormal function of one of the vital organs. Those chiefly affected are the circulatory and central nervous systems, and there is a variable amount of destruction of tissue which no amount of medication can repair. The progress of the disease may be stopped, large masses of diseased tissue may be removed, but the patient must learn to get along with what impairment remains. He should, before any treatment is given, be thoroughly examined, so that the full extent of the disease may be known. Mercury, arsphenamin, and the iodides should all be used in the care of the late syphilitic, but their sequence and the size of the dosage varies somewhat with the chief localization of the disease. The treatment is not, as a rule, given so intensively; and as medication is started, symptoms may sometimes be increased for the first week or two, thought due to the killing of numerous spirochaetes with the setting free of their toxins. In many cases, eradication of the disease cannot be hoped for, and the best that may be obtained is amelioration of the symptoms.

Circulatory Syphilis.—When there is involvement of the heart, or an aortitis or aneurism, treatment must be started cautiously. The accentuation of symptoms caused by the Herxheimer reaction in cardiac or aortic syphilis may lead to death. Mercury and potassium iodide should be given first for a period of five to six weeks. Then a series of five to eight doses of arsphenamin may be administered, the first 0.2 to 0.25 gram, and if this be well tolerated, the remainder in amounts of 0.3 to 0.35 gram. Depending upon whether or not there is improvement, several further courses of mercury and of arsphenamin may be given, usually with a rest from medication of five to eight weeks between each course.

Neurosyphilis.—Syphilis of the central nervous system, whether it be diagnosed by clinical signs and symptoms, or solely upon changes in the spinal fluid, requires immediate treatment. Mercury, iodides, and arsphenamin or neoarsphenamin are all to be used. Treatment is usually started with one of the arsenic preparations, and it may be administered in either or both of two methods—weekly intravenous injections, or intraspinal injections. As a rule it is best to begin with a long course of intravenous therapy. The first dose, in order that the tolerance of the patient to the drug may be known, is 0.2 gram arsphenamin (0.35 neoarsphenamin) and if this be well taken the remaining doses may be 0.3 to 0.4 gram arsphenamin or neoarsphenamin in proportion. In a small number of cases under such medication symptoms will completely disappear, and the Wassermann reaction and the cell count in the spinal fluid will become normal. Other cases may improve clinically, but the positive Wassermann reaction will persist, and still others may show no improvement. After long courses of arsphenamin or neoarsphenamin paræsthesia may be noted in the feet, and if treatment is persisted in, this will gradually mount to involve the whole leg. The paræsthesia will clear up slowly upon stopping administration of the drug, but arsphenamin may be resumed later in smaller doses and at longer intervals.

When clinical and serological improvement does not occur under intravenous medication, intraspinal therapy should be instituted.

INTRASPINAL TREATMENT.—Swift and Ellis first advocated the use of arsphenaminized serum intraspinally. Their technic, as originally described, has undergone but slight modification and as used at present is as follows: One half hour after the intravenous injection of arsphenamin, about forty cubic centimeters of blood is withdrawn into a sterile bottle-shaped centrifuge tube. It is then centrifugalized at high speed, usually twice, to rid the serum of all cells and fibrin; the serum is pipetted off, being careful that no blood cells are drawn up, and is inactivated for one-half hour at 56° C. It is then injected by gravity into the intermeningeal space.

Technic of Injection.—In place of the apparatus formerly used to determine the pressure of the cerebrospinal fluid, an amount of the fluid, approximately equal in bulk to that to be injected, is withdrawn and discarded. Then the barrel of a 30 to 50 cc. all-glass syringe is attached to the lumbar puncture needle by means of a forty cm. length of narrow rubber tubing, and, by lowering the syringe barrel, cerebrospinal fluid is allowed to flow into it to the 10 or 15 cc. mark. The prepared, warmed serum is then poured into the spinal fluid and the mixture is allowed to flow back into the cerebrospinal canal by raising the syringe barrel. At first, the dose is usually ten cc. and this is gradually increased in further injections, depending upon the reaction and clinical improvement, but not to exceed twenty-five cc. The interval between injections is usually two weeks, and for each injection the patient should be in bed and remain there, a strict bed patient for twenty-four hours.

There have been several modifications of the Swift-Ellis method of intraspinal treatment, chief of which is that known as Ogilvie's method. He advocated the use of human serum to which a solution of arsphenamin had been added, the actual amount of arsphenamin being 0.00025 to 0.0005 gram. Many syphilographers now use a combination of the Swift-Ellis and Ogilvie methods.

Other methods of intraspinal treatment are the addition of a small amount of a mercury salt to the patient's serum, and the intravenous injection of arsphenamin, with later drainage of the intraspinal canal.

The Swift-Ellis method is the one which is usually used and has given results as satisfactory as any.

At times after long courses of intravenous or intraspinal treatment of arsphenamin the patient may cease to improve, and then further improvement may result if all arsphenamin is stopped, and mercury and potassium iodide is administered by mouth.

When the liver is involved, in late syphilis, arsphenamin must be used cautiously if at all. As a rule none should be given until there has been considerable improvement under the administration of mercury and iodides. It is in cases with gummata of the liver or of the bones that potassium iodide is especially indicated, and the most remarkable changes are seen in these masses of necrotic tissue under administration of the iodides.

In all cases of late syphilis, even more so than in the early, syphilitic treatment should result in a feeling of well-being. As long as this is present the effort may be continued to effect a serological cure; but if the general health appears to suffer, specific treatment should be stopped until the patient is in better general condition.

Congenital Syphilis.—Mercury is best administered to infants by inunction, either the usual mercurial ointment or calomel ointment which should be smeared upon the flannel belly-band. If this be too irritating to the skin or if there be danger that the mother's suspicions be aroused, mercury and chalk in 0.03 gram ($\frac{1}{2}$ grain) doses three times daily may be used. In the case of the infant under two months of age it is probably best to use mercury first.

Later arsphenamin or neoarsphenamin may be used. The dosage is usually given as 0.0005 gram arsphenamin (0.001 gram neoarsphenamin) per kilogram of weight, but many consider the dose too small and advise as much as 0.01 gram of arsphenamin per kilo. The external jugular, the veins of the scalp, or the dorsal veins of the feet are usually chosen. Nearly all the men who have treated congenital syphilis condemn the injection by way of the superior longitudinal sinus as being too dangerous.

Fordyce advocates intramuscular injection of both mercury and neoarsphenamin to these patients. The mercury preparation is the bi-chloride. Neoarsphenamin is injected into the muscles of the buttock by means of a guarded needle, and to an infant of 3 to 8 weeks of age, 0.075 gram is given; for those of 2 to 6 months 0.1 gram; at 6 to 7 months 0.15 gram; and to children of 1 to 2 years of age, 0.15 to 0.2 gram is administered.

XXXIII. GONORRHOEA.

ALEC N. THOMSON AND WILLIAM BIERMAN.

A. In the Male.

The treatment of acute gonorrhœa is essentially chemical. The objective is to destroy the invading organisms by means of a gonococcidal solution. The possibility of accomplishing this is greatest when the solution used is introduced into the urethra immediately after the gonococcus has entered it. This clinically means that the chemical must be employed within eight hours after exposure. When it is used within two hours success is practically assured.

Prevention.—This “prophylactic” treatment is as follows:

1. The patient urinates.
2. Thoroughly wash the genitals and surrounding skin with soap and water.
3. Follow by bichloride of mercury (1 to 5000 solution) irrigation of the parts.
4. Fill anterior urethra with one per cent. solution of protargol. This must be retained for five minutes.
5. Apply calomel ointment ($33\frac{1}{3}$ per cent.) to genitals, thighs and lower abdomen. This must be thoroughly rubbed in and allowed to remain at least two hours.
6. The patient should return for observation during the subsequent four weeks.

Treatment.—The patient usually presents himself with a self-made diagnosis attributing his condition to one exposure some three to ten days previous. Occasionally he is incorrect. What appears to be the discharge of a gonorrhœal urethritis may be due to urethral chancre, balanitis or a non-specific urethritis.

To prevent a similar error the physician takes a careful history inquiring (in addition to age, occupation and marital status) as to the previous venereal history, in order to ascertain that the present attack is not an exacerbation of a pre-existing infection.

The genitals are then examined in order to note the amount and character of the urethral discharge and to obtain a specimen for microscopic examination. The gonococcus is a gram-negative diplococcus occurring in pairs. An aqueous stain such as methylene blue is sufficient for its detection.

The patient is then told to pass his urine into two clean glasses. If the first glass is cloudy and the second clear, an anterior urethritis is present (provided, of course, that a sufficient quantity of urine has been passed to wash out the anterior urethra). Cloudiness due to phosphates will disappear upon the addition of a small amount of acetic or nitric acid.

In undertaking the treatment of a patient for gonorrhœa, it is the duty of the physician to emphasize the seriousness of the disease, the necessity of avoiding sexual excitement and abstaining from intercourse, the need

for constantly wearing a suspensory for comfort and the avoidance of epididymitis, and the protection of others from contact with the discharge by the wearing of adequate dressings (gauze gonorrhœa bags) and their destruction preferably by burning.

Abortive treatment may be started if the discharge has been present less than forty-eight hours, is not purulent and the organisms are still extracellular.

A good method is that originated by Ballenger: first, the patient empties his bladder; second, 1 to 2 cc. (15 to 30 minims) of five per cent. argyrol are instilled into the urethra with the penis stretched; third, the meatus is dried and painted with flexible collodion. The glans is then painted with collodion for a half inch around the meatus; fourth, the patient does not urinate for four to seven hours; fifth, the procedure is repeated daily for five days, the patient resting almost continuously.

When the discharge has existed more than forty-eight hours the patient should keep quiet (preferably in bed), eat lightly (chiefly milk, cereals and vegetables—spicy, highly seasoned and rich foods are interdicted), drink plenty of water, and take sandalwood oil, 0.6 cc. (10 minims), three times a day if there is much burning on urination, and use an injection of protargol, one half of 1 per cent., or argyrol, 5 to 10 per cent., twice a day.

The physician should have the patient report daily for observation and injections of the same solutions, or of acriflavine, 1 to 5000, or mercur-ochrome, one half of 1 per cent.

It is essential that the patient be carefully advised and shown how to use an injection. After passing his urine and washing the glans and foreskin, he is told to slowly inject the medication by means of a plungerless urethral syringe holding two drams. The meatus is sealed with the finger as the syringe is removed and the solution retained for five minutes by the clock, and the bladder not emptied for at least one hour.

Solutions should be freshly made and injected at body temperature. Complaint of marked irritation indicates the necessity of diluting or discontinuing the medication. A too strong or a too long continued solution may cause a bacteria free discharge. The frequent use of the microscope aids in revealing this.

After an interval of a few days to a few weeks, the discharge will disappear and the urine become clear. In some cases the course of the disease will not be so smooth. The two glass test performed at every visit will detect the beginning of a posterior urethritis.

Acute antero-posterior urethritis or hyper-acute anterior urethritis, causing the patient to complain of pain on urination, frequency, urgency and tenesmus, calls for discontinuance of all intra-urethral medication, and the use of hot sitz-baths. Medication by mouth to allay the pain on urination is of value; *e. g.* sandalwood oil 0.6 cc. (10 minims) three times a day, bicarbonate of soda, 2 grams (30 grains) every four hours, or a teaspoonful every three hours of a mixture of citrate of potassium and tincture of hyoscyamus of each 12 grams (3 drams) in 100 cc. (3 ounces) of cinnamon water.

With the abatement of severe symptoms or at the inception of a posterior urethritis where the symptoms are not severe, the gonococcal solutions mentioned under acute gonorrhœa may be injected into the posterior urethra and bladder. For this purpose a hand syringe (plungerless) may be used or fluid injected by gravity with the container elevated four feet above the hips. To facilitate the passage of fluid into the posterior urethra the patient should take a deep breath and attempt to urinate to relax the sphincter muscle.

Diet, hygiene, self-injection are advised as in acute anterior urethritis.

Complications.—**Epididymitis.**—Epididymitis is a complication frequently avoided by careful treatment and adherence to hygienic instructions. Exertion, sexual activity, injections too vigorously given, instrumentation of the acutely inflamed urethra may be the factors responsible for this complication. Of great importance in the prevention of epididymitis is the wearing of a well-fitting suspensory during the entire course of a gonorrhœa.

All intra-urethral injections and instrumentation are stopped, the patient put to bed, the testicles supported by an adhesive plaster "bridge", from thigh to thigh, heat and local applications applied. Guaiacol in glycerine (25 per cent.) applied once a day for three or four days and followed by ichthyol ointment (25 per cent.) give the greatest degree of relief. Vaccines (non-specific protein) are at times valuable. Surgical intervention may be required.

Acute Prostatitis and Vesiculitis.—Frequency and urgency of urination, dysuria, tenesmus, rectal and perineal pain, call for a digital rectal examination which reveals enlargement and tenderness. Bed, light diet, hot sitz-baths, copious hot rectal irrigations, opium rectal suppositories, mild cathartics and discontinuance of all intra-urethral procedures are indicated.

Chordee.—To avoid chordee the patient should sleep on a hard bed, with light covers, and not on his back. In addition, immersion of the penis in hot water, emptying of the bladder and a 2 gram (30 grain) dose of bromide upon retiring are of value.

In the presence of chordee immersion of the penis in cold water and standing upon a cold surface give relief—this should be followed by a repetition of the above.

Treatment of Chronic Gonorrhœa.—The treatment of chronic gonorrhœa is essentially mechanical. The focus or foci responsible for the presence of a haze or shreds in the urine must be discovered. A chronically inflamed prostate and stricture are the commonest causes. If these can be excluded search must be made for other local conditions.

Chronic Prostatitis.—The presence of chronic prostatitis is determined by rectal examination, which reveals changes in size, contour and consistency, and by microscopic examination of the expressed prostatic secretion. The unaffected vesicle is not palpable. Normally the expressed secretion contains many lecithin granules and not more than three or four leucocytes to the oil immersion field. Inasmuch as a chronic prostatitis is the most

frequent cause for the continuation of chronic gonorrhœa, it is essential that smears of the expressed prostatic secretion be carefully examined. Some of the secretion is allowed to drop from the meatus upon a glass slide, spread thinly, dried in the air, passed three or four times through a flame, stained with an aqueous solution of methylene blue, washed in water, dried over a low flame (not by blotting) and examined under the oil immersion lens.

Two or three times a week the prostate is massaged. The bladder is filled with a solution of silver nitrate (1 to 3000), the patient stoops over a stool, grasps the seat, with the arms rigid, knees slightly bent, and toes turned inward. The physician separates the buttocks, inserts the well lubricated index finger (protected by a finger-cot), gradually carrying the finger as high as possible, makes pressure in the suprapubic region with the other hand upon the full bladder, thus having a bimanual control of the prostate. Beginning at the upper border inward and downward pressure is made toward the midline. This is repeated six times on each side, followed by three strokes along the prostatic cleft to evacuate the expressed material into the urethra. The patient then empties his bladder. The procedure should not cause pain or be too energetic. If the vesicles are involved their content should be expressed by a zig-zag motion downwards and inwards, prior to massaging the prostate.

Stricture.—The flexible bougie à boule is the best instrument to detect the presence of stricture and its use is indicated when there is difficult urination, diminished or forked stream or dribbling.

The stricture is dilated by the passage of sounds every five to seven days, beginning with one size smaller than the largest bougie passed and increasing one size at each visit.

The physician stands at the side of the patient, the shaft of the sound held parallel to the surface of the patient's abdomen, introduces the tip into the urethra making gentle pressure forward as the penis is brought over it. The sound is then slowly raised to a horizontal position which brings the tip to the sphincter with the curve in the bulbous urethra. Pressure is made upon the suprapubic region to relax the suspensory ligament while the other hand gently guides the handle of the sound downward as it "falls" into the bladder. Very little, if any, pressure is required. Thorough lubrication is essential. Bleeding usually indicates the use of too large a sound or too rough manipulation. An irrigation with silver nitrate, 1 to 3000, is given after the sound has remained in situ five minutes.

Where the size of the stricture is less than eighteen French, conical silk worm bougies are first used. If a bougie à boule cannot be passed the filiform bougie is used. The urethra is filled with a bland oil and the filiform is passed down to the stricture. If it does not pass a second and third are placed in position and one after another manipulated until entry into the bladder is accomplished. With great care and gentleness a tunnelled sound of small size is threaded upon the filiform and passed through the stricture. If this is not possible the filiform is tied in place.

Other responsible factors for the continuation of a chronic gonorrhœa are infections of the glands of Littre, crypts of Morgagni, cysts, etc., in the urethra. These are recognized and treated visually through the endoscope.

B. Gonorrhœa in the Female.

Gonorrhœa in women is all too frequently a symptomless disease. The absence of any subjective symptoms and the little importance attached to the leucorrhœal discharge which may be present account for the fact that a very large proportion of women so infected do not apply for medical treatment.

The presumptive existence of the disease is then often determined by the infection of the sexual partner, or by the later development of symptoms pointing to some gynæcological condition requiring operative interference—for example, a salpingitis or ovaritis.

Of the acute cases, where subjective symptoms are present, those pointing to an infected urethra are common, and are a sense of burning, worse on urination, and the presence of a purulent discharge. On examination the meatus is found to be inflamed, pouting, and bathed in a mucopurulent discharge in which the diplococcus of Neisser may be found. Frequently no discharge is noted unless the index finger is inserted into the vagina and then brought forward along its roof so as to strip the urethra—a drop of pus may then be detected issuing from the meatus.

Treatment.—For the acute stage the treatment should consist of rest in bed, drinking of large quantities of water, avoidance of spicy foods, alcohol, etc., a light bland diet, hot sitz-baths, and, for the relief of burning on urination, some alkaline mixture as suggested in the treatment of a similar condition in the male. With the subsidence of acute symptoms local applications should be made. Through a soft rubber catheter protargol, one half of one per cent., is injected into the bladder and then permitted to pass through the urethra. Later topical applications of silver nitrate, 10 per cent., to ulcerated areas may be made by means of the endoscope.

If an infection of Skene's glands be present, 10 per cent. silver nitrate may be injected into them by hypodermic syringe, or they may be incised and swabbed with carbolic acid, or destroyed by cauterization.

To investigate the condition of the vagina and cervix, the vulva should be thoroughly washed with soap and water, weak lysol or bichloride. The labia are separated and the region of Bartholin's glands palpated.

A small sterile speculum, well lubricated, is inserted and opened. In the presence of an acute cervicitis these organs will be found to be inflamed, ulcerated and bathed in pus. The post vaginal vault may be noted in a similar condition. The cervical and vaginal walls should then be dried by means of absorbent cotton on the end of an applicator or uterine dressing forceps, to be followed by the application of glycerine. Then a gonococcidal solution, such as used in the treatment of acute urethritis (argyrol, protargol, mercurochrome, or acriflavine), should be painted over the infected area. A suppository of protargol or argyrol may then be inserted and

permitted to remain, or else a tampon (for this purpose a one inch or more gauze bandage works very well) soaked in 10 per cent. argyrol may be inserted and permitted to remain for four hours. At the end of that time it is removed by the patient. Between visits the patient should endeavor to keep the parts clean by irrigation with potassium permanganate, 1 to 5000 solution. She should preferably be in bed so as to avoid exertion. She should follow the hygienic instructions advised in the presence of an acute gonorrhœal inflammation—a light diet, rest in bed, etc.

All manipulations should be made with gentleness. It is the opinion of some gynæcologists that all local manipulations within the vagina are best avoided inasmuch as they believe that such manipulations increase the danger of spreading the infection. They rely upon cleanliness of the external genitals, hot sitz-baths, rest, and a hygienic regime.

Complications.—**Bartholinitis** is a fairly common complication. Its presence is readily detected by noting the swelling in the region of the gland. During the early stages, before fluctuation may be detected, hot applications, rest in bed and sedatives for the pain should be ample. In the presence of an abscess incision brings immediate relief. This should preferably be made at the muco-cutaneous juncture. If the pus has been evacuated the cavity may be swabbed out with argyrol 10 per cent., or protargol 2 per cent., and a packing soaked in the same solution inserted. A chronically inflamed gland should be excised.

Vulvitis is more common in fairly young children than in the adult. Its presence in the adult is usually coincident with an inflammation of the vagina, cervix, or urethra, and the usual treatment must include these organs. The vulva should be kept free of discharge by frequent irrigation with boric acid or lysol one-half to 1 per cent. An ointment of 5 per cent. protargol is applied between irrigations.

Vaginitis calls for douching with warm boric acid or potassium permanganate, 1 to 5000, followed by the application of argyrol 10 per cent., or protargol, 2 per cent. The insertion of a suppository or tampon containing these gonococccides will help to continue their action for a longer period.

Endometritis.—The presence of endometritis is determined by the elevation in temperature, pain in the lower back, and a uterus tender to bimanual pressure. For the acute stage the patient must go to bed, be given hot sitz-baths and hot vaginal irrigations with boric acid or potassium permanganate. An analgesic antipyretic, acetphenetidin or acetyl-salicylic acid may be administered to alleviate the subjective symptoms.

When the condition becomes chronic the cervix should be dilated and the cavity of the uterus swabbed with argyrol or protargol, or with iodized phenol. If necessary—as in the presence of a persistent menorrhagia not influenced by the administration of ergot, hot douches, etc.—a curettage may be done and be followed by the application of the solutions mentioned. This should not be done, however, where the gonococcus is found in the cervical discharge.

Salpingitis and ovaritis usually occur together. In the acute stage

absolute rest must be enforced, and the bowels held open by means of laxatives. An antipyretic analgesic should be administered. Diet should be bland and fluids should be partaken of freely. With the subsidence of the hyperacute condition, hot vaginal douches should be given. When fever persists—due to the formation of abscess as detected by vaginal examination—these should be drained through the vaginal route. Abdominal surgery should preferably not be performed until the symptoms have quieted and then only if these symptoms persist for weeks or where exacerbations are frequently reported.

Venereal warts (*condylomata acuminata*) may be removed surgically with a scissors, scalpel, or curette; or chemically by means of a caustic, such as carbolic, or nitric acid, etc. They should then be kept clean and dry with some dusting powder.

C. "Cure" of Gonorrhœa.

After mature consideration of the criteria for pronouncing a case of gonorrhœa cured the All-America Conference on Venereal Diseases in December 1920 passed the following resolution:

"That with our present knowledge it is not scientifically and medically practicable to establish a standard for determining when gonorrhœa is cured. This statement, however, must not be understood as reflecting upon the ability of any specialist to make such a decision.

"In the female the condition is complicated, on account of the fact that the primary manifestations may be so slight as to cause the patient no annoyance, but particularly on account of the tendency of the disease to become latent. This latency is due to the fact that a minimal number of gonococci may be retained for months in a quiescent state in the depths of the cervical glands, and under certain conditions suddenly begin to multiply and give rise to an extension of the disease, accompanied by clinical symptoms. Accordingly, the disappearance of the initial clinical symptoms and the apparent freedom of the cervical secretion from gonococci do not necessarily indicate that the disease is cured.

"On the other hand, in the male it is practicable to establish a reasonable standard for determining when gonorrhœa has been 'probably cured.' The criteria are based upon two distinct entities: (a) cure of the infection; (b) cure of the lesions of the disease.

"In gonorrhœa, whether in the male or female, the duration of infectiousness has but a slight relation to duration of the lesions; that is, the symptoms may continue long after the infectiousness has ceased, and, conversely, infectiousness may persist after all obvious symptoms have ceased.

"As the problem is confined exclusively to the question of infectiousness, the word 'cure' as here used, will be understood as equivalent to cessation of infectiousness.

"There is no combination of clinical facts which constitute conclusive evidence of a cure of gonorrhœa in the male. Therefore, the determination as to whether cure has been effected depends upon the acumen and skill of

the physician. The patient may be assured that he is probably cured if all the following criteria are fulfilled:

"(a) No urethral discharge whatever for one month, during which time the patient is under observation without treatment.

"(b) The first ounce of urine passed in the morning free from any cloud of pus, as examined in a glass or bottle by a strong light.

"(c) All shreds in the urine continue to float at least two minutes after agitation of the fluid has ceased.

"(d) Massage of the prostate and seminal vesicles expresses a fluid which, when examined under the microscope, is found to contain no gonococci or pus cells.

"(e) It should be possible to pass a 26-F sound into the bladder, and examination the following day should satisfy conditions 'a' and 'b'.

"(f) If these findings are confirmed at a second examination one month later, during which time there have been no symptoms or treatment, the patient should be regarded as cured.

"All other cases should be examined by an expert, in order to determine whether or not they are cured."

D. Gonorrhœal Conjunctivitis.

Gonorrhœal conjunctivitis is, fortunately, a rare occurrence in the adult. Considering the prevalence of the disease and the closeness between the eyes and the genitals—via the finger, it is remarkable how seldom a conjunctivitis occurs.

Adult gonorrhœal conjunctivitis first begins to show symptoms after an incubation period varying from twelve to seventy-two hours; the condition is then acute, with the eyelids extremely red and swollen; severe burning and pain; and a hæmato-serous and later purulent discharge. On forcing the eyelid open the conjunctiva is seen to be inflamed and so swollen that the cornea seems to be sunken. The cornea frequently becomes ulcerated, leading to opacity. This is more apt to occur at the margin. Where the center becomes so affected, vision is lost. In some cases the infection extends to the interior of the eye and the resulting panophthalmitis causes its entire destruction. In such cases, unless sympathetic infection of the other eye really occurs, it is not necessary to remove the stump. Prophylaxis in the adult consists of instructions to cleanse the hands thoroughly after touching the genitals. Instillation into the conjunctival sacs of *every infant* at birth of a few drops of a gonococcal solution (silver nitrate 2 per cent. or argyrol 10 per cent.) is essential and is legally obligatory in some progressive communities.

Treatment should be begun after the microscope has shown that the inflammation is due to the gonococcus. To avoid infection of the *sound eye* by contagion, it is protected by a Buller's shield (consisting of two pieces of adhesive plaster placed face to face with an opening in the centre in which a watch glass is inserted), and the patient is instructed to lie on the side corresponding with that of the infected eye, to prevent any discharge from

running down into the healthy eye. The eye is very carefully and gently cleansed with boric acid solution and a few minims of argyrol, 20 per cent., instilled. With the subsidence of the acute symptoms the solution is instilled once a day.

The *infected eye* should be kept cleansed and free of discharge by irrigation with warm boric acid solution. This is done by means of a medicine dropper or some absorbent cotton. An irrigator or syringe might damage the delicate tissues or cause some of the solution to spread into the eye of the nurse.

Cold applications are of great value. This is accomplished by means of a Leiter's coil, or by compresses dipped in iced water. The latter should be renewed every few minutes throughout the twenty-four hours so as to prevent their becoming warm.

Ocular gonorrhœa may occur as a result of a systemic invasion. The resulting lesions, as mentioned by Byers in "Gonorrhœal Ocular Metastases," may be iritis, conjunctivitis, iridochoroiditis, keratitis, panophthalmitis, optic neuritis, dacryoadenitis, retinitis, tenovitis, thrombosis of the retinal vessels.

E. Constitutional Gonorrhœa.

The constitutional gonorrhœal infections are sepsis, a rapidly fatal hopeless process, and cardiac and articular infections.

The cardiac infections are usually of the type of malignant endocarditis, and are usually rapidly fatal. In the occasional mild forms, prolonged rest in bed, an ice-bag over the heart and a simple easily digestible diet may result in recovery.

Gonorrhœal arthritis is exceptionally rebellious to treatment, usually attended with prolonged swelling, and often results in permanent disability of the joint.

Treatment.—At first the joint should be immobilized by the application of a splint or plaster cast. Later, as the swelling and severe pain subside, passive motion, baking and counterirritation by the actual cautery are useful. It may at times be necessary to aspirate the joint cavity, and after fluid has been extracted, pressure should be applied by the application of a bandage or adhesive plaster straps. If the fluid be purulent, the joint cavity should be opened and drained.

Vaccines are usually unsatisfactory, but they may be tried in all cases especially as the condition becomes chronic. The initial dosage should be very small, 5 to 20 million organisms, and succeeding doses should be gradually larger, always avoiding a severe reaction. Whenever possible it is best to use an autogenous vaccine.

Antigonococcus serum has been found to be practically useless.

XXXIV. EPHEMERAL FEVER.

SAMUEL BRADBURY.

Ephemeral fever may be of infectious or of toxic origin, but in most attacks no cause can be assigned. All cases recover.

Treatment.—The patient is put to bed and a laxative administered. The diet is usually reduced to liquids and such soft solids as eggs, toast, and the lighter cooked cereals. A simple fever mixture may be prescribed.

XXXV. ROCKY MOUNTAIN SPOTTED FEVER.

The organism causing Rocky Mountain spotted fever is unknown, but it is well established that the disease is transmitted by a variety of wood tick, *Dermacentor venustus*. The tick lives in tall grass and in brush. Whenever it may be necessary to enter country where the tick is prevalent, the only protection is the wearing of tick-proof clothing. No adequate measures have yet been worked out to eradicate the tick.

Treatment.—The patient should receive the general care given any fever patient. Cold sponges may be used for nervous symptoms and hyperpyrexia. The diet should be liberal as there are no intestinal symptoms, and in order that the resistance may be strengthened as much as possible. There is no specific remedy, and the administration of arsphenamin is said to be even harmful.

XXXVI. ICTERUS INFECTIOSUS.

It has been found in recent years that many cases of *icterus infectiosus* are caused by a specific organism, the *spirochæta ictero-hæmorrhagica*, but it also seems probable that not all epidemics of infectious jaundice are due to this organism. The source of the spirochætal organism is the rat, but the mode of transmission of the organism from the rat to man is not understood. The spirochætes are eliminated from the body in the urine, and there is the possibility that food soiled with urine of rats is the cause.

Prevention.—The urine and fæces of a patient ill of the disease should be thoroughly disinfected to prevent further infection of the rat population. Food and water which are possibly polluted should be cooked or boiled before use.

Treatment.—The care of the patient ill of *spirochætosis ictero-hæmorrhagica* does not differ from that of any general infection. There is no specific treatment, arsphenamin being useless.

XXXVII. GLANDULAR FEVER.

The treatment is that of any simple fever—bed, a calomel purge and a light diet. Heat or cold, whichever may be most grateful to the patient, may be used on the glandular enlargements. It is rarely necessary to incise a gland. If nephritis develop, the treatment follows that given any acute nephritis.

XXXVIII. MILIARY FEVER.

The cause of miliary fever is unknown and the disease may be avoided only by absence from infected districts.

Treatment.—During the earlier stages of fever, cold sponges or ice compresses may be used. Later, when sweating is very severe, the water intake should be increased. The diet should be simple and nourishing throughout.

XXXIX. FOOT-AND-MOUTH DISEASE.

The disease is transmitted to others than handlers of cattle by the drinking of raw milk. Careful cleansing of the hands by those whose business it is to handle cattle, and the boiling of milk will prevent human infection.

Treatment.—Local treatment is all that is usually necessary. A mouth wash of potassium permanganate should be used frequently, and 10 per cent. silver nitrate solution may be applied to the ulcers.

XL. ERYSIPELOID OF ROSENBACH.

Local treatment is all that is necessary and is usually the application of 10 per cent. ichthyol ointment or wet dressings of lead water and laudanum. Tincture of iodine may be painted around and beyond the inflamed area.

II.

TREATMENT OF DISEASES CAUSED BY ANIMAL PARASITES.

E. U. REED.

A. DISEASES DUE TO PROTOZOA.

i. Psorospermiasis.

VISCERAL PSOROSPERMIASIS; COCCIDIOSIS.

Intestinal coccidiosis is not usually pathogenic. Rectal injections of silver nitrate solution and oral administration of methylene blue have been reported as cures of this infection. Hepatic coccidiosis is very rare and has not been recognized during life.

ii. Amœbic Dysentery.

Prophylaxis.—It is evident from investigation in the United States and in Europe that the war has returned to civil life great numbers of men who are carriers of pathogenic entamœba, and that a larger number of carriers than has usually been suspected exists in the normal population. All obscure intestinal cases should be examined and carriers treated, in order that complications may be avoided, and transmission of the infection to

others prevented. Cyst carriers are particularly dangerous when they can contaminate food or water supplies.

Flies and various other insects are important agents in the spread of this infection.

In the presence of amœbic dysentery, all water and food supplies should be boiled or cooked and subsequently protected from contamination.

The disinfection and sanitary disposal of fæces is of greatest importance as the cysts may remain viable for long periods of time.

Specific Therapy.—*Ipecacuanha* and its chief alkaloid, emetine, are specifics in this disease. To successfully eradicate the *entamoeba*, the drug must reach those in the intestinal walls through the circulation, as well as those in the intestinal tract.

Ipecacuanha must be given on an empty stomach. A preliminary dose of laudanum and a mustard poultice on the epigastrium are advisable to prevent rejection of the drug. Castor oil is usually used before starting the treatment to clear out the intestinal tract. The adult dose of ipecac is 1.3 to 3.0 grams (20 to 50 grains) daily for a week or longer, gradually reducing the dose as the symptoms improve. The full daily dosage is preferably given at night and the patient must remain in bed, without food, for six or eight hours to prevent emesis. The drug may be given in salol-coated pills, in capsules or suspended in water.

Emetine has largely superseded ipecac because of the discomfort frequently produced by the latter. Emetine hydrochloride or hydrobromide is given in 0.02 to 0.03 gram ($\frac{1}{3}$ to $\frac{1}{2}$ grain) doses, by hypodermic injection, two or three times daily for ten days. Larger dosage or prolongation of the treatment without interval is liable to produce serious toxic symptoms. The acute dysenteric symptoms usually subside steadily under this treatment, unless some intercurrent infection or complication is present, but recurrences are extremely frequent and simultaneous attack on the organisms by mouth is advisable, especially in the chronic cyst carriers. *Emetine and bismuth iodide* is given by mouth in 0.2 gram (3 grain) doses each night in gelatine capsules or salol-coated tablets for ten or twelve days in conjunction with emetine by hypodermic in cases with dysenteric symptoms, or it may be given alone in treatment of carriers.

Two or more courses of treatment, with one week intervening, may be necessary to effect a cure.

Chaparro amargosa is a bitter Mexican drug that apparently has some specific action in this infection. It is given as an infusion 180 to 240 cc. (6 to 8 ounces) three times a day before meals or as a fluid extract 4 to 8 cc. (1 or 2 drams) three times a day before meals, and at times an infusion is used as an enema. It does not produce the nausea and vomiting, when it is given by mouth that, so commonly, accompany the use of ipecac and its derivatives.

Symptomatic Therapy.—*Benzyl benzoate* in doses of 1.3 to 2.0 cc. (20 to 30 drops) of the 20 per cent. alcoholic solution, given three times a day after meals, is often very useful in relieving dysenteric symptoms.

Bismuth subnitrate or *subgallate* in doses of 8 to 12 grams (2 or 3 drams) suspended in water or milk may be used.

Epinephrin has been recommended and may be given in doses of 0.6 to 1.2 cc. (10 to 20 drops) of a 1 to 1000 solution every two hours by mouth. Daily enemas of the drug in saline solution (1 to 1,000,000 strength) have also been used.

Intestinal irrigations have been used quite extensively and are chiefly valuable for their cleansing effect. The drugs employed have been *quinine sulphate* (1:5000 to 1:1000), *tannic acid* (1:300), *silver nitrate* (1:2000 to 1:1000), *protargol* (1:500), and even *formalin*, *potassium permanganate*, and coal oil have been used.

General Therapy.—Rest in bed and an easily digested diet in small amounts are advisable until the symptoms are relieved.

TREATMENT OF LIVER ABSCESS.

This is the most important complication of amoebiasis. The prompt administration of emetine by hypodermic injection in the "presuppurative stage" may cause a subsidence of the liver symptoms. If an abscess has become established it should be located, drained, and emetine given during convalescence. The pus from such abscesses is frequently sterile but the abscess walls contain numerous entamoebæ.

iii. Trypanosomiasis.

African Sleeping Sickness.

Prophylaxis.—Infected districts should be avoided as much as possible. Certain areas in Africa have had to be entirely abandoned. Draining stagnant pools and clearing plant and tree growth for 5 to 30 yards away from all streams have been very successful in reducing the number of tsetse flies, as they require shade and moisture. Wearing white clothing, protecting legs and arms by clothing, and using screens and mosquito nets are advisable. There is evidently some animal reservoir of the infection in endemic districts, and killing off the game has been advocated on that account.

Human carriers should be recognized and patients isolated and protected from the tsetse flies.

Specific Therapy.—Intramuscular injections of arsenic in the form of *atoxyl* combined with *tartar emetic* intravenously gives the best results.

Atoxyl may be given in 0.13 to 0.2 gram (2 to 3 grain) injections every third day, or two injections of one-half gram ($7\frac{1}{2}$ grains) each, 48 hours apart, repeated every ten days.

Tartar emetic is given intravenously in doses of 0.03 gram ($\frac{1}{2}$ grain), gradually increased to 0.13 grams (2 grains), dissolved in 100 to 150 cc. (3 to 5 ounces) of water every day for 10 to 15 days.

The *atoxyl* is usually given fairly steadily and the *tartar emetic* intermittently for several years.

After invasion of the central nervous system has occurred treatment has nearly always been hopeless. Recently success has been reported from injection into the spinal canal of blood serum obtained from the patient one-half to three hours after intravenous administration of neoarsphenamin.

General Management.—If possible the patient should leave the tropics; any intercurrent disorders should be treated; and rest, good food, and protection from cold encouraged.

iv. Dum-Dum Fever.

Kala-azar.

Prophylaxis.—Owing to the present uncertainty as to the manner of transmission, preventive measures should be directed against bed-bugs and other possible insect hosts and dogs, which may be animal reservoirs of the infection, and patients and their effects should be segregated. Infected houses should be burned or thoroughly disinfected to kill all bed-bugs and other insects, and clothing and other articles used by patients should be similarly treated. Infected dogs and cats should be killed.

Specific Therapy.—*Antimony* has proved to be a specific in this disease as evidenced by prompt reduction in the fever and size of the spleen and increase in weight. Permanent cures are effected by its use if the disease is not too far advanced. *Tartar emetic* has been most frequently used in 1 to 2 per cent. solution injected intravenously every third day. The dose should be gradually increased from 0.03 gram ($\frac{1}{2}$ grain) of the drug to 0.1 to 0.13 gram ($1\frac{1}{2}$ or 2 grains) at each dose. Children may be given 2 to 10 cc. of a 1 per cent. solution at each dose. In infants a 5 per cent. ointment of metallic antimony may be used by inunction.

Rogers prefers a sodium salt of antimony* or colloidal antimony sulphide. If continued too long, antimony is liable to produce fatty changes in the liver and spleen. It should be discontinued after symptoms and organisms can no longer be detected.

Atoxyl, *arsphenamin*, and *quinine* have also been used, but with much less success.

Attempts to effect a cure by producing a leukocytosis with streptococcal vaccines, and tablets of splenic substance have been of little value.

Symptomatic Therapy.—*Sodium bicarbonate* should be used to combat acidosis; *calcium lactate* may be used to combat hemorrhages; and *bismuth subnitrate* may be useful in controlling the diarrhoea.

General Management.—Malaria or other intercurrent ailments should receive appropriate treatment. Nourishing diet, regulated according to the condition of the gastro-intestinal tract, and protection from cold and from all pyogenic infections are important.

v. Malarial Fevers.

Prophylaxis.—Preventive measures should be directed toward mosquitoes, human carriers, and individual protection against infection.

Mosquito-breeding places should be drained, filled in, or oiled with crude petroleum containing 1 to 2 per cent. of castor oil. These methods, conducted over large areas, are of established economic value.

Adult mosquitoes should be attacked by clearing away all underbrush near dwellings, careful screening, and use of fly swatters. Mosquitoes may be found hiding in closets and dark corners during the day. Burning sufficient sulphur or pyrethrum powder in each room will kill or stupefy them so they can be swept up and burned.

Small amounts, 30 grams (1 ounce) of pyrethrum, burned in each room, will drive the mosquitoes to the screen on a single window, left open for that purpose, and they can then be killed with a fly swatter.

Human carriers of the infection should receive adequate quinine treatment to eradicate the plasmodia. This has been done over large districts with excellent results. When one case in a family is treated, other members of the family should then be examined and other carriers of the infection also treated.

Individuals should be protected against infection by screening dwellings, sleeping under mosquito nets, remaining in screened enclosures as much as practicable after sunset, and use of quinine prophylaxis.

Head screens and gloves and certain volatile oils will aid in preventing infection by mosquitoes. On expeditions, camping on hills and avoiding swamps and native villages are of great importance.

Quinine prophylaxis has been extensively used and is of value over short periods of time, but should not be taken too continuously as it tends to result in the production of quinine-resistant plasmodia, which are more difficult to treat, and the paroxysms will have been postponed and not prevented in most instances.

Pernicious manifestations are especially liable to follow prolonged prophylactic use of quinine or inadequate quinine therapy. The usual dosage of quinine sulphate as a prophylactic is 0.3 gram (5 grains) daily and 0.6 gram (10 grains) on Sundays. One or two large doses after a particular period of exposure are more liable to be successful.

Routine Treatment.—*Quinine* is the specific for malaria and has been given in innumerable ways and forms. The method and form must be adapted to the particular case and the stage in which it is first seen but, so far as a routine can be established, the following is believed to be most advantageous in the majority of cases seen during an acute paroxysm:

1. *Calomel and sodium bicarbonate* should be given at once.
2. Keep the patient in bed, covered with blankets, during the cold stage and with an ice-cap or cold cloths on the head during the later stage of fever and headache.
3. Inquire about quinine idiosyncrasy and make blood smears for confirmation of the diagnosis. After quinine has been started, the plasmodia usually disappear promptly from the peripheral circulation.
4. After the sweat and a few hours rest, give a saline laxative.
5. Start the *quinine* in the form of the sulphate in 0.3 gram (5 grains)

compressed tablets, capsules, or cachets, giving 0.6 gram (10 grains) three times daily, and continue until the patient has missed a paroxysm. Then continue the quinine for two months, giving 0.6 gram (10 grains) each night.

6. Keep the bowels open throughout the treatment, by giving one or two doses of an aperient each week, and use liquid or light diet until the symptoms have abated.

7. Change of climate and iron and arsenic may be advisable after a severe attack because of the resulting anæmia.

8. Search for and apply appropriate treatment for any associated disorders that may delay convalescence.

Such a routine of treatment will be adequate for the majority of cases encountered outside of the tropics and for many in the tropics.

Calomel, at the beginning of the treatment, is most useful because of its effect on the nausea and vomiting and the sluggish condition of the liver and intestinal tract. It is often given, as a preliminary to quinine therapy, in very large doses, and rather large doses may be needed to produce satisfactory results.

During the paroxysm nothing is gained by unnecessarily adding to the patient's discomfort and he should be kept as comfortable as possible.

Quinine idiosyncrasy is occasionally encountered and may be most troublesome after even 0.06 to 0.13 gram (1 or 2 grains) doses. Its manifestations may be: (1) Cutaneous, with scarlatiniform, eczematous, or urticarial eruption and intense itching; (2) Gastric, with nausea and vomiting; (3) Aural, with vertigo and tinnitus; (4) Optic, with impaired vision and even temporary blindness; and (5) Renal, with hæmoglobinuria.

Idiosyncrasy can be determined from the history or by a needle scratch through a drop of 1:10 solution of quinine bisulphate placed on the skin. A cutaneous test is usually advisable before giving quinine intravenously. Desensitization may often be effected by giving daily and very gradually increasing doses of quinine commencing with 0.006 gram ($\frac{1}{10}$ grain). This method has the danger of desensitizing the plasmodia and the patient at the same time.

In a few cases desensitization has apparently been produced by one or two intramuscular injections of quinine; this method should be used rather than the intravenous, in cases in serious need of quinine, in whom idiosyncrasy is suspected.

The combination of *quinine with pepsin* has been found to produce less gastric reactions.

Quinine may be given in numerous ways but *oral administration* should be used when the paroxysms can be controlled in this way and intramuscular and intravenous injections reserved for cases with pernicious manifestations and some of the more virulent tropical infections.

A British commission, under the leadership of Sir Ronald Ross, and a commission in this country, under the Rockefeller Foundation and led by Doctor Charles C. Bass, have recently reached practically identical results in the determinations that *quinine sulphate* is equal or superior to any other

salt for oral administration; that administration in capsule is most convenient and generally satisfactory; that 2.0 grams (30 grains) daily is the optimum dose during the acute manifestations in the majority of cases; and that 0.6 gram (10 grains) daily should be continued for at least two months to eliminate the infection in the greatest number of cases. Ninety per cent. of cases and carriers were apparently cured in large districts of Mississippi under this plan of treatment.

Quinine in acid solution has influential advocates, but it is exceedingly bitter and the advantages of its greater solubility in this form are not conclusive. Dilute hydrochloric, hydrobromic and sulphuric acids have been used for this purpose, and frequently it has been given with lime or lemon juice and in wine.

Persons infected with malaria usually have an increased tolerance for quinine and very large doses are often given, but excessive dosage must be condemned, as it frequently produces symptoms not attributable to the malaria, and is apparently less effective than the less-depressing dosage previously outlined.

Intravenous administration is the most satisfactory in prompt control of severe infections. The writer has given over one thousand doses in this way. The usual dose is 0.5 to 0.7 gram (8 to 12 grains) of a soluble salt in distilled water. From the theoretical standpoint, it would appear safer to use 150 to 200 cc. of distilled water, but, from a clinical standpoint, the writer is convinced that a more concentrated solution produces less severe reactions if it is injected very slowly. The usual quantity of solution used has been 15 to 20 cc., and a 20 cc. syringe with an intravenous needle has been found most convenient. The quinine solution should be boiled thoroughly, (boiling does not appear to affect its therapeutic value) and injected under aseptic precautions. At least ten minutes should be taken in injecting the entire amount, and it should be discontinued if signs of dyspnoea or faintness develop. The patient should always be recumbent during the injection. The first dose should be a small one. The usual reaction is flushing, sweating, rapid full pulse, and, at times, a feeling of fulness or constriction in the throat, dizziness, and tinnitus. Temporary cyanosis, collapse, and signs of pulmonary oedema have been observed, but without serious results. A prompt injection of epinephrin or atropine should be given if severe reaction develops.

Intramuscular injection is indicated in the few cases in which the disease cannot be controlled by oral administration and intravenous administration is not advisable because of idiosyncrasy or lack of suitable equipment. In a few cases one or two intramuscular injections have appeared to desensitize the patients with idiosyncrasy, so that quinine could subsequently be given intravenously and by mouth without reaction. The danger of tetanus infection should be considered and every precaution used to prevent its occurrence. *Quinine and urea hydrochloride* in doses of 0.6 to 1.0 gram

(10 to 15 grains) should be used because of the local anæsthesia produced. The solution should be boiled two or three times to kill any spores that may be present, and 1.3 to 2.0 cc. (20 to 30 minims) of solution containing the appropriate dose should be injected well into the gluteal or shoulder muscles, avoiding the neighborhood of nerves, veins, and arteries. Injections of this salt have been followed by local necrosis and abscess formation.

Rectal injections of dilute quinine solution may occasionally be indicated in severe infections; especially in children. The dose should be correspondingly increased.

In treating children the tannate is often used because it is practically tasteless. The following doses of sulphate will be found most suitable for the accompanying ages:

Under 1 year.....	0.03 gram	($\frac{1}{2}$ grain)
1 year.....	0.065 gram	(1 grain)
2 years.....	0.13 gram	(2 grains)
3 and 4 years.....	0.25 gram	(4 grains)
5, 6 and 7 years.....	0.4 gram	(6 grains)
8, 9 and 10 years.....	0.45 gram	(7 grains)
11 to 14 years.....	0.5 gram	(8 grains)
15 years or over.....	0.65 gram	(10 grains)

In pregnancy the cautious use of quinine to control paroxysms is less liable to produce abortion than is untreated acute malaria. In such cases, the doses should be small and frequently repeated, and an opiate may be advisable.

After labor, in countries where malaria is prevalent, it is advisable to make smears from the placental blood and stain for plasmodia. If they are found, quinine should be given to prevent the paroxysms so frequently developing during the early puerperium.

Methylene blue, *arsphenamin*, and other drugs have been used without marked benefit during the acute stages. The latter may be of some value in chronic infections.

Exposure of the nude body to *sunlight*, after taking quinine, and the exposure of the spleen to very short periods of *röntgenotherapy*, have been advocated in chronic and rebellious cases.

Symptomatic Therapy.—*Hyperpyrexia* may require cold bathing, rectal injections of ice water, and ice to the head. Quinine must be given promptly.

Bilious vomiting requires prompt administration of quinine intravenously, intramuscularly, or by rectum. Antemetics may be used but their effects are not comparable to that of quinine.

Hæmoglobinuria (*Blackwater fever*) may produce very rapid death. Quinine has been considered contraindicated in this condition, but when numerous plasmodia are found in the blood it should not be withheld. Sodium bicarbonate should be given at the same time, intravenously, by mouth, or by rectum, as it is believed to markedly effect the hæmolysis. Hypertonic saline solution intravenously has also been advocated for this purpose. Transfusion of blood will, in some cases, be most beneficial.

In *malarial cachexia* with enlarged liver and spleen, a daily saline aperient, repeated courses of quinine, iron, and arsenic are needed. Such cases require good diet and hygienic management and frequently a change to a temperate climate may be necessary. Such change should be accompanied and followed by active quinine therapy or renewed paroxysms are very liable to be provoked by the change in temperature.

B. DISEASES DUE TO FLUKES—DISTOMIASIS.

1. Hepatic Distomiasis.—Infections with *opisthorchis sinensis* (clonorchiosis) may be treated with *thymol*, as described, under treatment of unicinariasis, or with *male fern*, as described under treatment of tapeworms. Injections of *tartar emetic*, as in bilharziasis, would appear to be more liable to cure this and other liver fluke infections.

The eating of raw or poorly cooked fish, molluscs and animal livers should be avoided in districts where this infection is endemic.

2. Pulmonary Distomiasis.—In infections with *paragonimus westermani*, *potassium iodide* has been recommended. Injections of *tartar emetic* should be tried.

In endemic areas all drinking water should be boiled; care should be exercised in the water used for bathing and all articles of diet, especially crabs and crawfish, should be well cooked.

3. Intestinal Distomiasis.—Infection with *fasciolopsis buski* or other intestinal flukes should be treated with *thymol* or *betanaphthol*. Both are effective and the latter is more pleasant to take.

Nothing should be eaten unboiled or uncooked in districts where the intestinal parasitic infections are prevalent.

4. Hæmic Distomiasis.—Bilharziasis.—Infections with *Schistosoma hæmatobium* (vesical schistosomiasis), *S. mansoni* (rectal schistosomiasis), and *S. japonicum* (oriental schistosomiasis) appear to be cured promptly by intravenous injections of *tartar emetic*. The dosage is gradually increased from 0.03 to 0.13 grams ($\frac{1}{2}$ to 2 grains) (dissolved in 20 to 50 cc. of sterile normal saline solution) given every alternate day until 1.3 to 2.0 grams (20 to 30 grains) have been given. Recently, *emetine* has been used where intravenous injections of tartar emetic were contraindicated. Emetine should be given in doses of 0.03 to 0.065 grams ($\frac{1}{2}$ to 1 grain) in 2 cc. of sterile water injected intravenously or intramuscularly and continued daily until 0.6 to 0.8 grams (10 or 12 grains) have been given. Its cumulative toxic effects should not be forgotten.

Bladder irrigations may be of value in relieving symptoms in the vesical form.

In districts where these diseases are endemic, the drinking of unboiled water and wading or bathing in streams, canals and ponds, where the fresh water molluscs that act as intermediary hosts may be present, should be avoided.

C. DISEASES DUE TO CESTODES.

i. Intestinal Cestodes—Tapeworms.

Prophylaxis.—Early recognition and treatment of infected persons and sanitary disposal of fæces are important. The food of domestic animals should be protected from fæcal contamination and meats that may be infected, especially beef, pork and fish, should not be eaten unless well cooked. Food should be protected from contamination by dogs, cats, rats and mice. After handling such animals, hands should be washed before food is handled. Children should be especially guarded in this respect.

Specific Therapy.—When ova or segments have been found in the fæces an anthelmintic should be given promptly, unless contraindicated by recent gastro-intestinal inflammation, severe cardiac or renal disorder, extreme weakness, pregnancy, lactation, menstruation, etc.

Prior to administration of an anthelmintic, food should be restricted for twelve to twenty-four hours to small quantities of milk and the gastro-intestinal tract should be cleared with *oleum ricini* (15 to 30 cc.) ($\frac{1}{2}$ to 1 ounce) or *magnesium sulphate* (15 to 30 grams). The purge is usually given in the evening, and on the following morning the anthelmintic is given on an empty stomach or after a cup of coffee or a glass of milk. The patient should be recumbent during the treatment.

Aspidium, the rhizome of felix-mas or male-fern, is probably the most uniformly effective remedy. It is usually given in the form of the oleoresin or the liquid extract in dosage of 2.0 to 4.0 cc. ($\frac{1}{2}$ to 1 dram) for an adult. Two hours later a calomel purge 0.3 to 0.6 grams (5 to 10 grains) followed by a saline should be administered. *Oleum ricini* and other oils should not be used, as they increase the absorption of the aspidium and the danger of poisoning. Four to eight cc. (1 to 2 drams) of the oleoresin have been given in divided doses in rapid succession to vigorous adults, but this dosage is not entirely safe. Overdose may cause vomiting, diarrhœa, collapse, blindness, jaundice, paralysis and even death.

Pelletierine, the active principle of pomegranate, is of nearly equal value in these infections. The adult dose is 0.2 to 0.3 grams (3 to 5 grains) of pelletierine tannate in capsule. It should always be followed in two hours by a purge. The fluidextract of pomegranate may be used in dosage of 1 to 2 cc. (15 to 30 minims) and a decoction of the bark has been used in dosage of 30 cc. (1 ounce) every hour until 500 cc. (1 pint) has been taken. Severe vomiting and purging are liable to follow the use of the decoction.

Pepo, the seed of the domestic pumpkin, is harmless and effective as a vermifuge for tapeworms. Sixty grams (2 ounces) of seeds, with outer coverings removed, should be rubbed up into an emulsion with water, taken on an empty stomach and followed in two hours by an active purge.

Brayera is another safe and valuable vermifuge for tapeworms. One half ounce of the powdered flowers in a pint of water and mucilage of acacia

(*infusum brayeræ*) or 15 cc. ($\frac{1}{2}$ ounce) of *fluidextractum cusso* may be used.

A purge should always be given after the anthelmintic has had time to stupefy the tapeworm and before the effects have worn off—preferably about two hours. The patient should be carefully attended until the whole worm, including the head, is expelled. The bowel movements should be received in a commode or bedpan containing warm water and no attempt should be made to pull on a protruding portion of the worm. If there is delay in expulsion of the worm a high, warm salt-water enema should be given. Unless the head is recovered and identified, an examination of the fæces for eggs or segments should be made in about two months, to determine whether another treatment is needed.

ii. Visceral Cestodes.

(a) **Cysticercus Cellulosæ.**—This is the larval stage of the *Tænia solium* and, as infection may occur through contaminated food and water and apparently also from an adult tapeworm in the intestinal tract of the same individual, prophylaxis consists in early recognition and treatment of *Tænia solium* infections, in avoidance of contaminated food and drink, and in sanitary disposal of infected fæces.

The cysticerci may be excised when they are superficially located. No successful medical treatment has been recorded when the larvæ have lodged and developed in the internal organs.

(b) **Echinococcus Disease.**—Infections with the larval or cysticercus stage of *Tænia echinococcus* may be reduced by killing stray dogs, avoiding the use of uncooked meat in kennels, the handling of dogs that may be infected, and care to avoid contamination of food for human consumption. Hydatid cysts should be removed or drained when they are accessible. Care is necessary to avoid spreading the infection. Formalin (1 per cent. solution) may be injected into the cyst and allowed to remain for five minutes before the cyst is opened.

Aspidrum has been reported as beneficial in this disease. It should be given as for intestinal tæniasis.

D. DISEASES DUE TO NEMATODES.

i. Ascariasis.

Ascaris lumbricoides (Eel worm).—Prophylaxis consists in the avoidance of contaminated food, drink, fingers and other things by which the ova may be introduced into the mouth. Cases should be promptly treated and sanitary disposal of fæces enforced to avoid spread of the infection.

Santonin is the most satisfactory remedy. The crystals should be used and they are usually combined with calomel in powders, capsules or cachets. The adult dose is 0.065 to 0.13 gram (1 to 2 grains) and that for children 0.015 to 0.03 gram ($\frac{1}{4}$ to $\frac{1}{2}$ grain) three times daily. *Santonin* is more effective on an empty stomach and should be followed by a saline

purge. Yellow vision, vomiting, diarrhœa, stupor, and paralyses may follow prolonged or excessive dosage.

Spigelia, in the form of the fluidextract and usually combined with senna, is very useful, especially in treating children. The dose of *fluidextractum spigeliæ* is 8 cc. (2 drams) to an adult and 2 to 4 cc. ($\frac{1}{2}$ to 1 dram) to a child of two years. The fluidextract of *spigelia* and senna (unofficial) is given in dosage of 15 cc. ($\frac{1}{2}$ ounce) to an adult, and 8 to 12 cc. (2 to 3 drams) to a child, in divided doses. Unless it is combined with senna it should be followed by a purge.

Chenopodium is also efficient in treating ascariasis. Its administration will be given in detail under the treatment of ancylostomiasis.

Oxyuris vermicularis (Thread worm; Seat worm).—The prophylaxis is the same as for *Ascaris lumbricoides* infection. Treatment by mouth and by rectal injection should usually be combined.

Santonin 0.03 gram ($\frac{1}{2}$ grain) with *calomel* 0.065 gram (1 grain) may be given three times daily for three days.

Quassia in the form of an infusion, made by soaking one ounce of powdered quassia or quassia chips in one pint of cold water, should be used by rectum. A cleansing enema should be followed by injection of 120 to 240 cc. (4 to 8 ounces) of warm infusion. This should be retained for several minutes by pressure over the anus if necessary. *Vinegar*, 15 to 20 cc. ($\frac{1}{2}$ ounce) to a liter (quart) of water, may be used.

A calomel ointment may be used externally to relieve the itching.

ii. Trichiniasis.

Infection with *trichinella spiralis* may best be avoided by killing rats and careful inspection and thorough cooking of pork and pork products before they are eaten.

If the infection is recognized during the stage of gastro-intestinal irritation, gastric lavage, active purgation with calomel or castor oil, and high colonic irrigations are indicated. *Benzene*, 0.6 to 0.8 cc. (10 to 12 minims) every two hours, may be given by mouth in mucilage of acacia and peppermint water. Four to eight cc. (1 to 2 drams) of benzene to a liter (quart) of water may be injected through a rectal tube.

Santonin and *calomel* two or three times daily may be given.

After the embryos reach the muscles medicinal treatment appears to have little effect. Hot camphorated oil rubs and hot baths may be used to relieve the pain and sponging with alcohol for the profuse sweats.

iii. Uncinariasis.

Ancylostomiasis; Hook-worm Disease.*—The spread of this disease is essentially through soil pollution, and its prophylaxis consists in educating the community into the uniform sanitary disposal of fæces and wearing of shoes, and in recognition and treatment of carriers. Where the disease is

*S. M. Lambert, Jour. A. M. A., 1922, 79, 2055, Dec. 16, advises the use of carbon tetrachlorid in a dose of 3 to 4 cc. (45 to 60 minims). I do not know that any one else has used this drug and its recommendation should follow that for the use of oil of chenopodium.

prevalent, all anæmic persons and those having eosinophilia should be subjected to examination of the fæces for *ancylostoma* ova and to treatment when the ova are found.

Specific Therapy.—*Oil of chenopodium* is probably the most efficient drug for treatment of this infection. The dose usually given to adults is 1 to 2 cc. (15 to 30 minims) in gelatine capsules given in two portions two hours apart. Preliminary starvation and a preliminary purge are not necessary and do not increase the efficiency of the treatment. No food should be given during the treatment. The second dose should be followed in two hours by a saline purge. *Oleum ricini* should not be used. Two such treatments, given ten days apart, will cure over 90 per cent. of infections. The fæces should be examined for ova and the treatment repeated at ten-day intervals until no more ova are found.

This drug is cheaper than thymol and its results more uniform. It also eliminates *Ascaris lumbricoides* and *Oxyuris vermicularis* infections. No alcohol or acids should be ingested immediately before or during a treatment. It is contraindicated in chronic nervous disorders and extreme weakness, and a few deaths have been reported from its use.

It can be given to young children in doses of 0.06 cc. (one minim) for each year of age and repeated after two hours. The dose may be given on sugar instead of in capsules.

Nausea and vertigo are rather frequently produced but usually disappear after the purge is given. Temporary deafness may be produced. Some preparations of the drug are apparently more toxic than others and only reliable ones should be used.

It may be given through a duodenal tube, and one dose of 2 cc. ($\frac{1}{2}$ dram), given in this way, and followed in ten minutes by 90 cc. (3 ounces) of warm magnesium sulphate solution through the tube, will apparently cure practically all cases in one treatment. Less nausea, vomiting, and burning in the epigastrium appear to attend this method.

Thymol has been more extensively used and is also efficient. It should be preceded for several days by doses of sodium bicarbonate. The diet should be light or liquid during the preceding day, in the evening of which 30 to 60 grams (1 or 2 ounces) of magnesium sulphate should be given and no supper allowed. Early the following morning, one-half of the desired dose of thymol should be given; followed by the other half two hours later and by magnesium sulphate two hours after the last dose of thymol.

The thymol is best given in capsules with sugar of milk; 0.3 gram (5 grains) of thymol in each capsule. The desired amount may be given in three doses, two hours apart. If severe epigastric burning or cardiac or respiratory symptoms develop, no more thymol should be given, but hot coffee and strychnine should be given as indicated and the purge should be administered at once. No food should be taken, and the patient should remain in bed on his right side until the purge is effective. No fats, oils, or alcoholics should be permitted on that day.

The adult dose of thymol is usually 4 grams (60 grains) though 6

grams (90 grains) has been used. It is a dangerous poison in overdose. The dosage for children is:

Under 5 years	0.5 gram	(7½ grains)
From 5 to 9 years.....	1.0 gram	(15 grains)
From 10 to 14 years.....	2.0 gram	(30 grains)
From 15 to 19 years.....	3.0 gram	(45 grains)

All the parasites are expelled by the first treatment in 25 to 50 per cent. of cases. Two or three treatments, a week or more apart, are often required to eliminate all of the parasites.

Betanaphthol, finely powdered, and *phenolphthalein* may be given together in capsules and other purges omitted. The dose of betanaphthol is the same as of thymol; it is also given in two or three portions and sufficient phenolphthalein added to produce free purgation. Betanaphthol is a renal irritant and is contraindicated in renal disease.

Children and debilitated persons may be treated with *oleum eucalypti*—2 cc. (30 minims), *chloroform*—2.6 cc. (40 minims), and *oleum ricini* 40 cc. (10 drams) given in two portions a half hour apart. It is not as efficient as the other treatments but is safer. It can be repeated daily for several days.

iv. Filariasis.

1. *Filaria bancrofti*.—Prophylaxis consists in use of mosquito nets and destruction of mosquitoes.

During acute attacks of filarial fever, lymphangitis and lymphadenitis, tincture of ferric chloride in doses of 2 cc. (30 minims) three times daily appears beneficial. Rest and elevation of the inflamed part and anodyne applications are indicated.

Rogers has produced definite diminution in the number of embryos in the peripheral blood by intravenous administration of a 1 to 500 solution of *sodium antimony citrate* daily for eight days and then every alternate day. The dose is gradually increased from 2½ to 5 cc. (½ to 1 dram) of the solution.

Arsenical and other preparations have been used without apparent benefit in this infection.

Bladder irrigations may be necessary in cases of chyluria.

Elephantiasis has been treated by bandaging, massage, and subcutaneous tube drainage but without marked benefit. Localized elephantoid enlargements may be amputated. This is most successful in elephantiasis of the scrotum. All of the elephantoid skin and subcutaneous tissue should be removed, with the elephantoid lymph glands in the groin, and normal skin brought together as well as possible over the testicles and around the penis. The inner layer of the prepuce is usually not involved and will furnish a covering for the penis; the weight of the elephantoid mass has often pulled normal skin down from the abdomen and thighs, so that very satisfactory closure may often be obtained.

2. *Filaria diurna*.—The adult, *F. loa*, may be located in the subcutaneous tissues and removed. It can travel at the rate of about one-

half inch a minute and rapid work is necessary under local anæsthesia to effect removal. Local anodyne applications should be applied to the Calabar swellings.

3. *Filaria perstans*.—No successful treatment has been recorded for this infection.

v. Dracontiasis.

Guinea-worm Disease.

Filaria (Dracunculus) medinensis.—Prevention consists in avoidance of water containing infected cyclops.

After inducing emptying of the uterus by repeated douching of the ulcer, the adult female may be removed by carefully grasping and winding on a smooth round instrument. If the worm breaks and a portion remains under the skin, a painful abscess will usually result.

Macfie has used intravenous injection of *tartar emetic* with much success in this infection. 0.06 gram (1 grain) of tartar emetic should be dissolved in 2 cc. ($\frac{1}{2}$ dram) of normal saline solution containing $\frac{1}{2}$ per cent. of phenol and injected intravenously. It should be freshly prepared and injected every alternate day for six injections. The course of injections may be repeated if symptoms recur.

Trichocephalus dispar (*T. trichiuris*; Whipworm).—Sanitary disposal of fæces and personal cleanliness are the best preventive measures.

Aspidium and *thymol* have been used but are often unsuccessful. Colonic irrigations of *benzene* 4.0 to 15.0 cc. (1 to 4 drams) in a liter (quart) of water may be used.

III.

THE TREATMENT OF THE CHRONIC INTOXICATIONS.

J. C. WILSON.

I. ALCOHOLIC INTOXICATION.

Alcoholism.—Acute, chronic, and hereditary intoxication and dipsomania will be considered. The conditions arising from the excessive and habitual use of ethyl or grain alcohol, recently called also ethanol, as a beverage are referred to. Similar, but much more dangerous, intoxication caused by methyl alcohol or methanol, used in the arts and especially to render ethyl alcohol unfit to drink, will be separately considered. Since the passage of the Eighteenth Amendment to the Constitution of the United States, methyl alcohol, being comparatively inexpensive and easy to obtain, has been widely employed, by unscrupulous and reckless persons, as an admixture in and substitute for grain alcohol in beverages, in disregard of its intensely poisonous properties, and defiance of the law.

General Prophylaxis.—The prevention of the evils of excess by the control of the sale of drink constitutes one of the more important objects of state medicine. At the same time, the traffic in alcohol is curiously evasive of legal enactments. The difficulties attending the enforcement of sumptuary laws are well known. Restrictive laws concerning the making and sale of alcoholic drinks, while partaking of the nature of sumptuary laws are of more comprehensive character, being obnoxious to powerful commercial interests and to the sense of personal liberty of large numbers of persons of all classes. As a result of organized opposition and individual violation, they are to a great extent inoperative as regards the prevention of alcoholism.

Aside from the question of revenue from taxation, the practical influence of law in this matter has been until recently somewhat limited, being confined chiefly to the prevention of the sale of liquors to minors and persons already intoxicated, and to ineffectual attempts in certain countries to regulate the quality of the drink sold. The penalties for personal drunkenness which does not lead to overt acts are, as a rule, wholly inadequate to restrain it. The best results upon anything like an extended scale have been obtained by the coöperative action of philanthropic individuals in endeavoring to influence the moral tone, especially among workingmen, to diminish temptations, and to provide for leisure hours, in the absence of drink, reasonable amusements and occupation to pass the time ordinarily spent in taverns and similar places.

The decrease in the consumption of alcoholic drinks in the United States in recent years was doubtless due in part to increasing popular knowledge concerning the dangers of alcoholic excess and to the growth of a more wholesome public sentiment. The United States awaits with a profound interest the outcome of the recent Prohibition Amendment. A law that cannot be enforced tends to widespread disdain of all law.

Individual Prophylaxis.—The prevention of alcoholism consists in complete abstinence from, or the most guarded indulgence in, alcoholic beverages. The victims of drink are found among the ignorant, the very poor, and especially among neurotic subjects in all classes of society. This fact underlies the responsibility of those not so unfortunate, in two respects: first, that of example, and second that of personal restraint from the standpoint of heredity. This factor plays a certain rôle. Much of the tolerance exhibited by individuals, families or nations is to be thus accounted for. It is certain that most of the evils and crimes of alcohol-drinking communities are due directly or indirectly to the abuse of this agent.

The Treatment of Acute Alcoholism.—The medical treatment of mere drunkenness requires no consideration. The rapid elimination of alcohol, and the transient nature of its pathological effects in excesses which are not repeated or prolonged, explain the spontaneous recovery, which is usually prompt. The physical suffering and mental distress following unaccustomed excesses are not lasting. A powerful effort of the will is sufficient to control the more moderate effects of alcohol. A similar result follows the

use of cold douches, the Turkish bath, and full doses of certain preparations of ammonium, particularly the official solution of the acetate of ammonium. In acute alcoholic stupor, the patient may be left to himself, care being taken that the clothing is loosened and that the position is such as to prevent local paralysis from nerve-pressure. Alcoholic coma, if of moderate intensity, may be managed in the same way. Profound alcoholic coma requires more energetic measures. Frictions, artificial warmth, stimulating enemata, as of turpentine or of hot salt and water, hypodermic injections of strychnia or atropia in minute doses, and, occasionally, repeated inhalations of ammonia, and cold effusions, followed by brisk frictions with warm flannel and faradism of the respiratory muscles, may be needed to tide over the threatened fatal collapse. The stomach should be at once washed out with hot coffee.

In the convulsive forms of acute alcoholism chloral in 0.6 gram (10 grains) doses, repeated at intervals until 2.4 grams (40 grains) have been given, usually serves to arrest, or moderate, the paroxysm. It may be administered by the mouth or in double doses by the rectum. If chloral be inadmissible, by reason of weakness of the circulation, paraldehyde may be substituted in doses of from 2 to 4 mls ($\frac{1}{2}$ to 1 dram) repeated at intervals of from one to two hours until quietude is produced. Where the convulsive paroxysms are of great violence it may be necessary to control them by the cautious administration of ether by inhalation.

The mania of acute alcoholism calls for energetic management. To avert injury to the patient himself or to those about him he must be confined, if practicable, in a suitable apartment in a hospital; if not, in his own house, and carefully watched. Here paraldehyde, chloral, or large doses of the bromides constitute efficient means of medication.

In acute alcoholism it is a rule to at once withhold alcohol in every form and all doses. If, under exceptional circumstances, great nervous depression or flagging circulation seems to call for the use of alcohol in small amounts, it is far better to substitute other drugs. The frequently repeated administration of hot beef tea or rich broths in small doses, with capsicum and the use of the various preparations of ammonia, or small doses of opium, with or without quinia and digitalis, proves useful in proportion to the skill and discrimination with which they are selected and repeated. It is a good plan to commence the treatment with an active purge.

In the acute collapse following excessive doses—lethal doses—the stomach is to be immediately emptied by the tube or pump and washed out with hot coffee. In the absence of the stomach tube emesis may be provoked by the use of mustard or sulphate of zinc or by hypodermic injection of apomorphia. The patient must be placed in the recumbent posture and surrounded with hot blankets. The cold douche may be occasionally applied to the head and face, and the muscles of respiration may be excited to action by faradism. Artificial respiration and friction of the extremities may also be required. Inhalations of ammonia may be used. The flagging heart may be stimulated by occasionally tapping the precordia with a hot

spoon—Corrigan's hammer. Hypodermic injections of digitalis may be employed. Overwhelming doses of alcohol, leading promptly to collapse, usually prove fatal despite all treatment.

Chronic Alcoholism.—Whatever may be the prominence of particular symptoms or groups of symptoms, whether they indicate derangement of the viscera, of the nervous system, or of the mind, whatever their combination, the fundamental therapeutic indication in chronic alcoholism is the withdrawal of the poison. The condition is directly due to the continuous action of a single toxic principle; its relief when practicable, its cure when possible, are only to be obtained by the discontinuance of that poison. This is a matter of great, often of insurmountable, difficulty. The obstacles are always rather moral than physical. Occasional or constant temptation, the iron force of habit, the malaise, the faintness, the craving of the nervous system, and, worse than all, the enfeebled intellectual and moral tone of the confirmed drunkard stand in the way. Even after success seems to have been attained, and the patient, rejoicing in improved physical health and in the regained companionship and consideration of his family and friends, feels that he is safe, it too often happens that, in an unguarded moment, he yields to temptation and relapses into his old habits. It is necessary to guard the patient against the temptation to drink. To secure this he may be sent as a voluntary patient for a length of time to a suitable institution, or, still better, he may place himself under the care of a conscientious, clear-headed country doctor in a sparsely settled region, preferably in the mountains or at the seaside. The malaise, depression, insomnia, and other nervous symptoms when of moderate degree are best treated by abundance of nutritious and easily-assimilable food, taken often and in moderate amounts. Grave visceral lesions characterize a more advanced alcoholic cachexia and necessarily complicate the treatment. The nervous symptoms require special medication. The whole group of tonics, from simple bitters to quinia and strychnia, is here available. It is impossible to lay down rules for the treatment of particular cases. In the absence of conditions calling for special treatment, such as gastritis, hepatic or pulmonary congestion, fatty heart, etc., good results follow the frequent administration of small doses of quinia and strychnia; thus, the patient may take 0.06 gram (1 grain) of quinia six or eight times a day or a little gelatine-coated pill containing 0.0003 to 0.0006 gram ($\frac{1}{200}$ to $\frac{1}{100}$ grain) of strychnia every hour during the waking day, amounting in all to 0.003 to 0.012 gram ($\frac{1}{20}$ to $\frac{1}{5}$ grain) in the course of twenty-four hours. This treatment is often followed by the relief of tremor, the quieting of nervous irritability, and the production of good general results. The malaise, the general depression, and especially the sinking feeling at the pit of the stomach so often complained of by patients, are best relieved by food.

Cold or tepid sponging, the occasional hot bath at bedtime, and the Turkish bath are useful adjuvants to the treatment. As a rule, opium is contraindicated. Sleep often follows the administration of a cupful of hot broth or milk at bedtime. If necessary, hypnotic doses of chloral or paral-

dehyde may be used, but care is required in their administration, and their early discontinuance is advisable. If anæmia be profound, chalybeate tonics do good, and among the preparations of iron, Blaud's pills are especially useful.

In conditions characterized by failure of mental power, in beginning dementia or threatened insanity, the syrup of the hypophosphites, the compound syrup of the phosphates, or cod liver oil should be administered. These remedies are likewise useful in various forms of alcoholic paralysis, as are also faradism and galvanism. Alcoholic insanity requires special treatment, only to be had in institutions designed for the care of patients suffering from mental diseases in general.

It is essential in the treatment of all forms of chronic alcoholism to secure the permanent discontinuance of the alcohol habit; but the skill, judgment and experience of the physician must determine the degree of rapidity with which this is to be done. The number of cases in which alcohol can be discontinued at once and finally is limited; those in which it can be wholly given up in the course of a few days constitute the largest proportion; in a small number, alcohol can only be withdrawn cautiously and by degrees. A wholesome open-air life, with sufficient daily exercise to induce fatigue, and the companionship of interested and judicious friends are important.

Delirium Tremens.—The patient should be confined in a large, well-aired apartment, with little furniture except his bed, and when practicable he should have a constant attendant. The favorable influence of a skilful nurse in tranquillizing these patients is very great. The custom of strapping them to the bed by the wrists and ankles is to be deprecated. If the case be a mild one, and especially during convalescence, open-air exercise in the sunshine, with an attendant, is of benefit; care must be taken to guard against escape.

Under no circumstances should visitors be permitted to see the patient. In young persons the treatment may be preceded by an active saline or mercurial purge. In elderly persons, those suffering from cachectic conditions, or in cases characterized by marked debility and feeble circulation—conditions frequent in persons who have had repeated attacks—it is not desirable to purge. Alcohol should be wholly withdrawn or rapidly diminished. It must be replaced by abundant food in the form of concentrated broths or meat extracts. In cases of vomiting, these must be given hot and in small doses frequently repeated. Bitter infusions may also be given, or milk, or equal parts of milk and Vichy water. If there be thirst, the effervescent waters may be given freely. Patients often drink with satisfaction and apparent benefit hop tea, which may be made simply with water or with equal parts of water and porter.

The medicinal treatment will depend to a large extent upon the peculiarities of the case. In mild cases a combination of the watery extract of opium in small doses, not exceeding 0.016 gram ($\frac{1}{4}$ grain) with quinia and digitalis, repeated every four or six hours, is often useful. Although the

view, once entertained, that the graver symptoms were the result of prolonged sleeplessness is no longer tenable, the induction of sleep, or at all events of mental and physical repose, is among the more important therapeutical indications. For this purpose hypnotic doses of opium are not only undesirable, but are even, in the majority of instances, attended with danger. The sleep which follows repeated and increasing doses of opium in delirium tremens has too often terminated in coma deepening into death. As calmatives, extract of *cannabis indica*, hyoseyamus, or the fluid extract of piscidia are useful. As hypnotics, the bromides, chloral and paraldehyde yield, in the order here given, the best results. The bromides are better in large single doses than in small doses often repeated; better in combination than singly. Chloral, either by the mouth or by the rectum, in doses of from 0.6 to 1.2 gram (10 to 20 grains) is often followed by beneficial sleep. It is contraindicated where the heart action is much enfeebled. Paraldehyde, in doses of 2 to 4 mls. ($\frac{1}{2}$ to 1 dram) repeated at intervals of two or three hours until sleep is induced, is still more efficient. This drug may be administered without the fear of its exerting a depressing influence upon the heart. Hyoscine or scopolamin hydrobromide may be given in doses of 0.0003 gram ($\frac{1}{200}$ grain). The depression may be combated by repeated small doses of champagne or by carbonate of ammonium 0.3 gram (5 grains), the vomiting, by withholding food and medication by the mouth for some hours. Excessive restlessness is sometimes favorably influenced by cold effusion, followed by brisk friction and warm blankets with continuous artificial heat. The cold pack has proved useful.

Digitalis may be employed, *ex indicatione symptomatica*, but enormous doses of tincture of digitalis are here mentioned only to be condemned.

To sum up, the chief indications for treatment are complete isolation; the withdrawal of alcohol; abundant, readily assimilable, nutritious food; and control of the reflex excitability of the nervous system.

Hereditary Alcoholism.—The treatment of the vicious propensities of the descendants of alcoholic parents does not fall directly within the province of the physician. It is among the most difficult problems of education. The recognition of the cause of evil traits manifested in childhood and youth may do something to avert dangers commonly unsuspected. All things considered, the outlook is not hopeful. The recognition on the part of the physician of the influence of hereditary alcoholism in cases of arrested development, feeble organization, or declared disease of the nervous system will perhaps do less to aid his treatment in many cases than to reconcile him to its want of full success. The cry of warning to those who are eating sour grapes is that the teeth of their children will be set on edge.

Dipsomania.—The general indications for the treatment of dipsomania are two: first, the management of the paroxysm; second, the control of the general condition itself.

During the paroxysm the patient must be saved from the danger of injuring himself or others and from squandering his property. If the excesses are of such a degree as to render it practicable, the same treatment must be

carried out as in cases of acute alcoholic mania and delirium tremens—namely, confinement in a suitable apartment under the care of an experienced nurse and the control of the doctor. Unfortunately, this plan is not always practicable in the early days of the outbreak. Here, repeated small doses of quinia and strychnia are of advantage. Courses of arsenic at the conclusion of, and in the intervals between, the paroxysms are of use, on account of the excellent influence they exert on the general nutrition. These may be advantageously alternated with iron, cod liver oil, and the compound syrup of the phosphates or of the hypophosphites. Hydrotherapy may also be used with advantage, and the influences of a well-regulated hydropathic establishment are much more favorable than those of institutions especially devoted to the treatment of alcoholic subjects. In the latter the moral atmosphere is apt to be bad; the patients support each other, and too often conspire to obtain in secret that which is denied them openly, or, if the discipline be too strict for this, they sympathize with each other in their restraint, react unfavorably upon each other in the matter of shame and loss of self-respect, and plot together to secure their liberty.

Few dipsomaniacs in the earlier periods are proper subjects for treatment in hospitals for the insane. If cerebral excitement or sleeplessness persist after the paroxysms, chloral, paraldehyde, or the bromides in large doses may be used to secure sleep. Various combinations of the bromides are often of use where the single salts fail. It must not be forgotten that during the paroxysm there is great danger lest the patient do himself or others harm. When there are indications of an impending attack, and during the period of depression following the attacks, benefit is derived from the daily use of bitter infusions. As a matter of fact, however, the management of these cases is among the most unsatisfactory of medical undertakings. The difficulty is increased by the latent character of the mental disorder in the intervals between the attacks. Even when such patients voluntarily enter hospitals for the insane, they cannot be retained there sufficiently long to derive any permanent benefit. What we want is, in the words of Clouston, “an island where whiskey is unknown; guardianship, combined with authority, firmness, attractiveness, and high, bracing moral tone; work in the open air, a simple natural life, a return to Mother Earth and to Nature, a diet of fruits, vegetables, bread, milk, eggs, and fish, no opportunity for one case to corrupt another, and suitable punishments and deprivations for offences against the rules of life laid down—all these continued for several years in each case, and the legal power to send patients to this Utopia for as long a period as medical authority determines, with or without their consent.”

i. Wood Alcohol.

Methyl alcohol, methyl hydrate, methyl hydroxide, known commercially as “methanol,” wood alcohol, wood naphtha, wood spirit or carbinol is a colorless, inflammable liquid, closely resembling ethyl alcohol

in its general properties. In the arts it takes the place of grain alcohol to a great extent, its solvent powers being very similar. It cannot be taken internally, however, as it is highly poisonous, undergoing oxidation in the body with the production of formaldehyde and formic acid, both of which are corrosive poisons having a peculiar selective action upon the ganglion cells of the retina and fibers of the optic nerve, and frequently causing permanent atrophy and total blindness. Its virulence as a general poison is manifest by the intensity of the intoxication which it produces and the frequency with which death results. The circumstances under which poisoning by wood alcohol occurs make it difficult to estimate the quantity acting in any given cases, but it has appeared probable that only 4 mls (1 dram) has produced blindness and that death has followed the ingestion of 30 mls (1 ounce). It is very probable, however, that extremely minute quantities have been present in spirituous liquors of superior quality and that, as in the case of most poisons, there are minimal doses that are innocuous.

Methyl alcohol is obtained by the dry distillation of wood, and is marketed for commercial purposes in varying degrees of refinement. When thoroughly deprived of contaminating substances, it is clear, not unpalatable, and has a vinous odor compared with ethyl alcohol; its price, though fluctuating, is low, and its solvent powers are such as to create a constant demand for it in many arts and manufactures. It is therefore readily procurable and since the enactment of the National Prohibition Amendment, the partial enforcement of which rendered normal alcoholic beverages difficult to obtain and enormously costly, poisoning by wood alcohol has become common.

General Prophylaxis.—The following facts concerning wood alcohol constitute a basis for the prevention of the evil consequences attendant upon its misuse:

1. Its character as a deadly poison even in small quantities. A few drinks, a single debauch, has caused blindness and death.

2. It enters the body and exerts its toxic effects by ingestion not only as a substitute for or admixture with ordinary alcoholic drinks, but also as an ingredient of bay-rum, lilac, and violet waters, witch-hazel, Jamaica ginger, various flavoring extracts as vanilla, lemon, peppermint, cinnamon, anise and colognes, all of which at times are consumed in quantity by alcohol addicts. In its pure state it is sold for the manufacture of such substances under various commercial designations as "Purified Alcohol," "Columbian Spirits," "Eagle Spirits," "Greenwood Spirits," and the like. It is used to fortify and preserve ginger ale, bottled cider, and similar beverages by unscrupulous manufacturers.

3. It may enter the body in doses sufficient to produce poisonous effects, when freely applied to the skin over large surfaces and repeatedly, in the form of liniments and embrocations. Poisonous symptoms have occurred in persons handling antifreeze mixtures, largely composed of wood alcohol, in garages.

4. Inhalation of the fumes in the handling of methyl alcohol in the making of the substances above described, and in the use of lacquers, lacquer work and varnishes in close and ill-ventilated rooms, may eventually cause ocular lesions and loss of sight.

The wide distribution of knowledge concerning the above facts would greatly diminish the evils attending the reckless employment of wood alcohol in the ordinary affairs of life. It is a matter of education. Preventive medicine finds in this matter a field of usefulness not yet fully cultivated. Not only are the people to be educated, but the law givers are also to be taught. More definite, comprehensive and reasonable laws must be enacted and rigorously enforced. Among the measures suggested are a return to the former formula for denatured alcohol—methylated spirit—which was methyl alcohol 10 parts and ethyl alcohol 90 parts, but since 1919 has been changed to $\frac{1}{5}$ as much methyl alcohol; the use of a low grade of methanol, more nauseating and less poisonous, for the purpose of denaturing grain alcohol; the general effective compliance with the requirement that tax-free grain alcohol for use in the arts and industries must have such a substance mixed with it that will “destroy its character as a beverage or render it unfit for liquid medicinal purposes;” the posted notification of all workers engaged in the industries in which methanol is used, of its poisonous nature and the proper precautions by which its injurious effects may be avoided; the use of “Poison” labels on all containers of perfumes, essences, liniments, lacquers and varnishes, in which wood alcohol is present; otherwise, the filing of an affidavit that the alcohol content is pure grain alcohol and that wood alcohol is not present; the registration of sales in such a manner that in case of poisoning the source may be established, the sale of any liquid containing methanol for beverage purposes to be regarded as a crime punishable by fine and imprisonment; and finally, the general use of the term “methanol” in place of any designation in which the word *alcohol* or *spirits* appears.

Individual Prophylaxis.—The above measures would greatly diminish the dangers attending the industrial use of methanol, but the ignorant or reckless confirmed addict and the dipsomaniac will, even under favorable conditions, furnish an occasional case for diagnosis and treatment. Under existing circumstances, methanol poisoning is likely to continue to be common.

In the acute cases the diagnosis may be established by the circumstances under which the poisoning has occurred, and the nature of the symptoms. If a small quantity of the fluid can be obtained, the presence of methanol may be detected by the following means:

Mulliken and Scudder's Test.—A spiral copper wire, heated red hot, is plunged into the suspected liquid in a test tube. Oxidation takes place with the liberation of formaldehyde which may be recognized by its pungent odor. The test is not very delicate, requiring ten per cent. of methanol for a satisfactory reaction.

King's Test.—Bay-rum or other suspected liquid should be decolorized by shaking with magnesium carbonate and filtering. The reagents must be

tested for formaldehyde to eliminate false results and the material under examination should be tested before, as well as after, examination. Dilute a few cubic centimeters of the fluid with distilled water; add approximately 0.2 grams of KMnO_4 and boil gently for about five minutes. During the boiling a funnel should be kept in the neck of the bottle to prevent evaporation of formaldehyde, if any be present. More potassium permanganate must be added if the fluid in the flask is decolorized while boiling. After the boiling the fluid is decolorized with a few crystals of oxalic acid. Put 5 mls of this mixture in a test tube and add 2 mls of milk, mixing thoroughly. Underlay this with the sulphuric acid reagent (100 mls of concentrated sulphuric acid plus 1 ml of Fehling's copper solution). If paraldehyde be present, a violet ring will form at the line of contact.¹

Treatment.—The symptoms vary according to the degree of intoxication, and the circumstances under which the poison has found access to the body.

Ingestion.—If the patient comes under medical observation within ten or twelve hours, an emetic should be at once administered. For this purpose a tablespoonful (15.0) of mustard stirred in a glass of warm water; a teaspoonful (4.0) or more of the syrup of ipecac repeated at short intervals and followed by a glass of warm water; or 1.3 to 2.0 grams (20 to 30 grains) of zinc sulphate, not to be repeated, may be given. Whether vomiting occurs or not, the stomach should be washed out in the course of 10 or 15 minutes, and the lavage repeated from time to time. The depression already present, or likely to occur with great suddenness, is a contraindication to the employment of apomorphine. With care and suitable assistance, gastric lavage can be performed when the patient is unconscious. Alkaline solutions of sodium carbonate or bicarbonate 2 per cent. or magnesium carbonate or oxide may be used for this purpose. Later magnesium sulphate or citrate should be given as a purgative. Meanwhile the tendency to acidosis may be counteracted by the free use of weaker solutions of sodium bicarbonate by mouth and rectum. Formaldehyde and formic acid have been detected in the stomach washings for several days and repeated lavage is regarded as diminishing, to some extent, the danger of ocular lesions. Catharsis, enteroclysis and, if necessary, hypodermoclysis may be maintained, at intervals, for several days and hot packs or vapor baths used to promote diaphoresis.

Simultaneously with the above evacuant, eliminating and neutralizing measures, energetic means should be employed to counteract the depression which constitutes the immediate danger. External heat should be applied and a free circulation of air maintained in the apartment. The continuous inhalation of oxygen² and prolonged artificial respiration may be necessary to tide over respiratory and cardiac depression, and avert the collapse, which in the course of the second twenty-four hours is frequently the fore-

¹R. W. King, U. S. Nav. Med. Bull., Oct., 1919.

²There are theoretical objections to the use of oxygen. It has been thought that it might hasten the conversion of the formaldehyde into formic acid; but since it has been shown that when pure oxygen is inhaled no more oxygen is absorbed by the blood than when atmospheric air is inhaled, these objections do not hold. The oxygen increases pulmonary ventilation, and stimulates respiration by acting upon the nervous system.

runner of death. Among the remedies available are atropin, caffeine, camphorated oil, digitalis, and strychnine, all of which may be administered hypodermically. It is useless under the circumstances to use drugs of this kind simultaneously or in quick succession. Dependence should be placed upon that one which has been selected as suited to the condition of the patient, and the dose, repeated at such intervals and increased or diminished according to the effect, a synergist being cautiously added in response to some clear indication—epinephrin solution, 0.6 mil (10 minims) of the 1 to 10,000 solution or the liquor hypophysis 1.0 mil (15 minims) hypodermically injected. These substances may be injected intravenously under suitable precautions.

Cutaneous Absorption.—The conditions under which poisoning by methanol thus occurs are usually such that the toxic effects are slowly brought about by minimal doses long continued. The victims are entirely ignorant of the danger to which they are exposed in their daily affairs as barbers, bath rubbers, attendants upon rheumatic and neuralgic patients, veterinarians, chauffeurs and others who use or handle various lotions or other fluids containing the poison. Some deteriorating influence upon the general health doubtless occurs, but the symptoms are not distinctive, and it is not until persistent dimness of vision is noticed that methanol poisoning is suspected.

Inhalation.—This form of poisoning is also insidious and chronic. It is likewise chiefly occupational, occurring among painters, varnishers, users of shellac, and certain dyes, and workers in factories where rubber goods are made. Constitutional effects have not been recognized and studied; but after a time the evidences of functional and structural impairment of the visual organs develop.

Ziegler,¹ whose studies in methanol poisoning, alike in its general aspects and its ophthalmologic manifestations, are of great value, regards the stimulating effects of negative galvanism as of the highest value in revascularizing the disk and restoring the impaired function of the optic nerve. He believes "that electricity is the most efficient therapeutic measure we have for the milder cases of toxic injury in which there has not been complete destruction of the nerve fibres. If this has already occurred... galvanism will have no effect whatsoever."

II. THE OPIUM HABIT AND KINDRED AFFECTIONS.

The principal habit-forming drugs are opium, its derivatives, morphia and heroin (diacetylmorphine), cocaine, paraldehyde, cannabis indica, ether and chloroform. Of these opium and morphia are used by most habitues in all classes of society; heroin and cocaine chiefly by criminals and prostitutes, while occasionally the others are habitually taken for effect by apothecaries, physicians and others connected with medicine as an occupation. The habitual abuse of narcotics, while producing effects modified by the char-

¹ Jr. A. M. A. Oct. 8, 1921.

acter of the respective drug, tends to become confirmed and ultimately establishes a condition in which the ordinary functions of life are properly performed only under the influence of the customary dose; and in which its absence results in languor, depression and serious derangement of bodily and mental processes. The habit, once established, thus makes for itself a constantly recurring and urgent plea for its continuance; especially is this true for opium and morphia.

The treatment naturally arranges itself under the headings of prevention and cure, and the consideration of the opium habit indicates in a general way the principles underlying the management of habitual narcotism in its various phases.

Prophylaxis.—The Harrison Act is a reasonable effort to regulate and control the sale of narcotics, but its enforcement, while limiting their sale on prescription, has enormously increased the illicit peddling and distribution of heroin and cocaine, and created a criminal knowledge and demand which is as widespread as it is dangerous. The scale upon which this nefarious traffic is carried on is so great, and the profits from it so enormous, that ordinary police regulations are unequal to its control, and its corrupting influence is widespread and far-reaching. There is urgent need for clearly expressed comprehensive laws, rigorously enforced, with heavy penalties for violation and no loop-hole for the escape of any culprit.

The practice of using narcotics in increasing doses for the relief of recurring pains in neurotic individuals is a dangerous one. The occasional necessary recourse to them should be guarded with every precaution. The patient should be kept in ignorance of the drug used and its dose; the minimum dose capable of affording relief from suffering should be used; occasional change of medicines of this nature should be made and the physician must be on his guard against the danger of allowing a merely palliative treatment to take the place of radical measures to secure early and permanent relief. More reprehensible than the neglect of many practitioners, who disregard these precautions, is the folly of the few who entrust to the patient himself or to those in charge of him the hypodermic syringe.

The dissemination of a wholesome knowledge of the manner in which drug habits are acquired and their serious character constitutes an important measure of prophylaxis.

Curative Treatment.—Attempts to treat the opium addict who is unwilling to submit to complete control, are uniformly unsuccessful. Only exceptionally can such cases be managed satisfactorily at home. In the upper rooms of a large private house, with well-trained and experienced attendants and the full coöperation of those in authority in securing the seclusion of the patient, success may sometimes follow. Satisfactory isolation is best obtained in private rooms of general hospitals or well-organized sanatoriums. Institutions which use the public press to advertise certain and rapid cures, by secret processes and remedies are, for obvious reasons, to be avoided.

There are various methods:

1. **The Abrupt Discontinuance of the Drug.**—This plan, known as the method of Levinstein, at one time widely employed under various modifications, is no longer practised. It fell into disuse because it was attended in all cases by indescribable sufferings and in many by serious dangers.

2. **The Rapid Withdrawal of Opium with the Substitution of Other Drugs.**—This method is based upon two hypotheses:

(a) That the tolerance which enables the addict to take enormous doses of opium or its derivatives is due to the production of an antibody which, upon the deprivation of the narcotic, causes the group of withdrawal symptoms. As the result of the habitual ingestion, inhibition of the detoxicating and excretory functions of the body takes place, and opium is accumulated in the cells, especially those of the liver, and is given off into the circulation as the inhibition diminishes, and the organs tend to resume their normal functions. The re-entry of this stored-up substance into the circulating blood results in the formation of new antibodies which in turn occasion a new set of withdrawal symptoms, and a corresponding craving for more opium or heroin as the case may be. The method of Bishop, which is based upon this hypothesis consists in the administration of the narcotic in amounts which gradually permit the reestablishment of the bodily functions as far as possible, at the same time eliminating the narcotic accumulation by active cholagogue catharsis. After some days of this preliminary treatment, the habitual narcotic is wholly discontinued and scopolamine given in its place. At the end of several days, during which the abstinence symptoms, if they have not already disappeared, gradually cease, scopolamine is discontinued and building-up treatment is instituted.

(b) The second hypothesis, that of Stokes, has for its basis the assumption that the opium is simply a poison having a selective action upon the automatic nervous system and the suprarenal bodies. Eserin and pilocarpin are regarded as physiological antidotes, stimulating secretion and diaphoresis, and they are administered as the habitual drug is gradually withdrawn.

3. **The Gradual Withdrawal of the Drug.**—This method has much to recommend it, especially in institutional work and in the sanatorium management of cases. The details as described by Hamilton, Commissioner of Correction, New York,¹ are as follows:

"In an uncomplicated case the patient goes immediately to Riker Island, where he starts on the cure. Here they determine his bodily needs; *i.e.*, he is given sufficient opium to keep him out of pain. This is a variable amount, but as a rule fifteen drops of Magendie's solution administered three or four times a day is sufficient. The dose is prescribed at or near mealtime as an inducement for him to take some nourishment. If necessary, a laxative is given. The opium is gradually withdrawn, one drop each day, so that at the end of two weeks the patients are completely off the

¹ N. Y. Med. Jr. Sept. 21, 1921.

opium and are then given strychnine or some supportive measure. The insomnia is taken care of by sedatives, preferably hyoscyamus, and the patients are taken out of doors as quickly as possible. The best somnifacient is not drugs, but fresh air and exercise. A body physically tired will sleep. The use of drugs and sedatives is to be curtailed as much as is possible."

"The nourishing of these drug addicts is a vital element of treatment. Sufficient food of an easily digested kind must be given. Overfeeding is avoided. Over a thousand drug addicts have been treated in the department with an average gain in weight of between 35 and 40 pounds. The patients are kept under observation for at least one hundred days, and overcome the craving for the drug. The question in each case then becomes a sociological one. Unfortunately, after a time recommitments are common. The success of this method of treatment is largely due to psychic influences and the deep interest and personal supervision of the resident physician, Dr. MacVean, have been important factors."

When morphine is given hypodermically, injections during the early part of the treatment should be so timed that the period of sleep or drowsiness which they produce should occur during the night. As soon as the number of injections is reduced to one daily, that one should be administered at the latest convenient hour before midnight. For twenty-four or forty-eight hours after the final discontinuance of morphine, but little effect may be expected from ordinary doses of other sleep-inducing drugs. Chloral, in single large doses 1.3 to 2.0 grams (20 to 30 grains) either alone or associated with a corresponding large dose 2.6 to 4.0 grams (40 to 60 grains) of one of the bromides, administered on the second or third night after total suppression, is very often followed by prolonged tranquil and refreshing sleep. Caution must be observed, however, in administering chloral so long as the indications of feeble circulation persist. Paraldehyde, although less certain, is a less dangerous hypnotic under such circumstances. Massage, hot baths, and the cold pack are all useful adjuvants to the treatment. The sweating, when copious and distressing, is favorably influenced by sponging with hot alcohol.

The abject mental state of the patient calls for much firmness, and tact on the part of the physician and attendants. Every effort should be made to inspire courage and hope. Neither the importance of the symptoms nor the intensity of the sufferings of the patient should be underrated; nevertheless, the ordeal is a limited one. In many instances, to get rid of the opium means to get well, because opium, unlike alcohol, does not leave permanent structural lesions of any organ. The expectation of a radical cure may therefore be presented to the patient as a consolation in his sufferings.

With the return of convalescence sexual power is restored and menstruation reestablished. Insomnia and muscular weakness usually persist into the convalescence for some weeks, and only gradually yield to careful regulation of the daily life of the patient, with abundant nutritious food,

open-air exercise, and change of scene. The insomnia of this period constitutes a serious symptom, for the reason that it constantly subjects the patient to the temptation to return to the use of hypnotics. In the course of time, however, the normal physical and mental condition is regained, and the patient may be permitted to return to his former pursuits and associations.

The Chloral Habit.—That which has been said in the foregoing pages concerning the prophylaxis against the opium habit applies with equal force to chloral and other narcotics. The curative treatment of habitual addiction to chloral is attended neither by the³ difficulties nor the dangers which are encountered in the management of the opium habit. The symptoms attending the discontinuance of chloral are less severe and less persistent; in fact, individuals accustomed to the taking of large doses of chloral not infrequently voluntarily discontinue its use for considerable periods of time. As a rule, the treatment may be carried out at home, the patient, however, being isolated and cared for by a watchful attendant. The drug should be stopped at once. For the first few days, alcoholic stimulants should be freely given. Systematic feeding, full doses of quinine, followed after a time by strychnia and, as soon as the condition of the digestive system will permit of it, by iron, fulfil the general indications. Cod liver oil and malt extracts may be given with advantage. Cardiac failure, collapse, and delirium tremens are to be treated in the same manner as similar complications occurring in the treatment of the opium habit. Vomiting is much less likely to occur, and when present is less persistent and less difficult of management. Diarrhœa does not usually prove troublesome, the bowels, on the contrary, being constipated. The latter condition yields to mild laxatives or to simple enemata. Hemorrhages from the various mucous tracts may be controlled by fluidextract of ergot, or the hypodermic injection of liquor hypophysis. The conjunctivitis, which is occasionally present, usually subsides spontaneously upon the discontinuance of chloral. It may be treated by instillations of a 2 per cent. solution of cocaine and mild borax lotions 1 per cent. The after-treatment must be carefully carried out. Relapses are less frequent than after the opium habit.

The treatment of habitual addiction to paraldehyde, cannabis indica, ether, chloroform, etc., must be based upon the general principles indicated in the foregoing pages. Cases of the habitual abuse of these drugs are comparatively infrequent on the one hand, and on the other do not often present the serious and progressive symptoms produced by excesses in opium, cocaine and chloral; hence they come but rarely under the care of the physician except in those unhappy individuals in whom the propensity to vicious narcotism is such that any drug capable of producing excitement and oblivion is made the means of gratification, and all are used by turns as the opportunity occurs.¹

¹ A System of Medicine by American Authors. Courtesy of Lea & Febiger, Philada., and New York. Vol. V.

III. CHRONIC LEAD POISONING.

Prophylaxis.—Metallic lead is probably inert, but owing to the ease with which it oxidizes and forms salts, lead in any form, if introduced into the body continuously for a length of time, produces characteristic toxic effects. The oxides, acetates and carbonate of lead, being soluble in the gastric juice, act more surely. But the sulphate, the least soluble of the lead compounds, may also have this effect. (Gasserow).

The channels by which lead is introduced into the body are the alimentary canal, the respiratory tract and the cutaneous surface. Hence the modes of introduction are of almost endless variety. The conveyance of lead into the stomach constitutes the most common, as well as the most important, means of access to the organism. This may be in the form of medicine, as the acetate, the unduly prolonged use of which, even in moderate doses, sometimes produces chronic poisoning. Articles of diet are not infrequently contaminated by lead derived from different sources, of which the most common is the lead glaze of earthenware vessels, which is soluble in acid fluids. According to Naunyn, beer drawn through lead pipes may cause chronic lead poisoning, which has also been frequently ascribed to the use of shot in cleaning bottles used for wine and malt liquors. Drinking water is occasionally contaminated with lead derived from pipes made of this metal and cisterns painted with lead colors. Pure water, freed from gases, does not act upon lead when the air is excluded. In the presence of air, however, an oxide of lead is formed which is partially soluble in water. If nitrates, nitrites and chlorides, such as constitute ingredients of sewage, are also present, they form soluble compounds with lead and increase the proportion of lead salts soluble in the water. For this reason water contaminated by sewage is rendered decidedly more dangerous if carried in leaden pipes. On the other hand, the purer the water the greater the danger. Hence rain-water and pure spring-water cannot safely be stored in cisterns painted with lead colors nor conveyed in leaden pipes, nor can lead covers be used for cisterns, because of the condensation of the vapor of water, which drops back, holding lead salts in solution. The sulphates, phosphates and carbonates usually found in river waters, form insoluble lead compounds which, being deposited upon the interior of the pipes, act as protective and prevent further chemical changes.

Still more common is the accidental conveyance of lead dust and lead compounds to the mouth in consequence of their adhering to the hands or settling from the atmosphere upon articles of food and drink, in the case of workmen engaged in the various arts in which lead is freely used. As a rule, to which exceptions are rare, the more severe cases of chronic lead poisoning occur only among workers in lead, as miners, those employed in white lead factories, painters, typesetters, plumbers and lapidaries.

Potters engaged in the glazing of common pottery and tiles, workmen in file factories, workers on colored papers and in enamels, especially in glass enamels, brush-makers for the reason that the bristles are sometimes colored

by lead preparations, and those engaged in sewing coarse goods because the thread is sometimes treated with a preparation of lead in order to add to its weight, are likewise liable to chronic lead poisoning. The introduction of lead into the body through the respiratory tract is a subject of the greatest importance in the trades. Inadequate ventilation of working-rooms, living or sleeping in apartments connected with or contiguous to factories in which lead is largely used, and particularly in lead factories, is attended with serious dangers, as is also the habit of eating food in such apartments or drinking water that has been standing in them. The possibility of lead poisoning by way of the respiratory tract has been questioned. In view of existing knowledge as to the readiness with which carbon in minute states of subdivision finds its way into the connective lymph-channels of the lung, there can be no doubt that the habitual respiration of an atmosphere loaded with the dust of lead or its preparations in a minute state of subdivision may give rise to chronic lead poisoning. At the same time, the experiments of Hassel render it probable that less absorption takes place directly by means of the pulmonary mucous membrane than by way of the mucous membrane of the mouth and throat. As treated in the industries none of the preparations of lead are volatile. This affection is also occasionally observed in clowns and others upon the stage or elsewhere, who habitually use cosmetics containing lead. The use of cheap tinfoil, into the composition of which lead enters largely, as a wrapper for tobacco and snuff is said to occasionally produce chronic lead poisoning. It is stated by Naunyn that mattresses filled with horsehair, died black by lead compounds, have occasioned this affection. The same authority states that a proof reader was poisoned by reading printed proof for many years. Chronic lead poisoning is pre-eminently a disease of the industrial arts.

The quantity of lead absorbed is of less importance than is its continuous introduction. The phenomena of chronic lead poisoning are those brought about by the gradual accumulation of lead in the system, the amount absorbed into the blood in any given cases being comparatively small, even where large quantities are ingested. Hence prolonged exposure to small amounts of lead is attended with more danger than a comparatively brief exposure to large quantities. It is stated that the members of the household of Louis Philippe at Claremont manifested the symptoms of chronic lead poisoning after the lapse of seven months in consequence of drinking water which contained a mere trace of lead. On the other hand, several grains of acetate of lead may often be administered medicinally to patients, for a week at a time, without inducing the phenomena of this affection although, in view of the idiosyncrasy of many individuals, the exhibition of lead preparations for prolonged periods is not advisable.

Free ventilation and scrupulous cleanliness constitute, in general terms, the most efficient safeguards for those whose occupations involve prolonged exposure to lead. Workmen employed in lead factories, and those otherwise exposed to lead, should be compelled to wash their hands and change their outer clothing before eating; they should also bathe regularly every

day on leaving work; under no circumstances should they be suffered to eat or sleep in or near the workshops. As all kinds of work in the manufacturing of lead preparations are not attended with equal risk, the workers should, from time to time, be transferred from one department to another or from indoor to outdoor work. In order to prevent the constant rising of dust, the floors are to be kept constantly sprinkled or covered with moist sawdust. It is unnecessary to go into further details in regard to the hygiene of the subject. It is probable that towels and sponges worn over the mouth, or other forms of respirators, because of the inconvenience which they occasion and the false sense of security which attends their use, are of less value than has been generally supposed.

It appears scarcely needful to here insist upon the avoidance of cosmetics and hair dyes containing lead, or upon the exercise of reasonable prudence in the matter of the manufacture, sale and use of articles of food or drink which are liable, either by accident or design, to become adulterated with lead compounds.

The use of sulphuric acid lemonade is a measure of prophylaxis of less real value than was at one time supposed, seeing that the sulphate of lead is itself capable of producing the disease. Occasional doses of magnesium sulphate are of use where a tendency to constipation exists. Workmen who begin to show signs of chronic lead poisoning should without delay abandon their work and seek some occupation free from its peculiar dangers.

Curative Treatment.—When the disease shows itself, no matter in what form, the primary indication is the discontinuance of exposure to lead. Chronic cases of malnutrition, constipation, functional nervous disorder, will occasionally be found, upon careful search, to depend upon long exposure to lead in some unsuspected way. The cause being removed, such cases often promptly recover.

Measures aimed first at the separation of the lead from the tissues, and then at its elimination from the body constitute a rational treatment. Sulphur baths and the internal administration of sulphur may be employed with a view of converting the lead eliminated by the skin and mucous membranes into an insoluble sulphide, and thus preventing its resorption. Repeated laxative doses of castor oil will remove unabsorbed lead from the intestinal canal. The plan of treatment at present in general favor consists in the combined use of potassium iodide and magnesium sulphate. From 0.3 to 0.6 gram (5 to 10 grains) of the iodide are to be given in not less than 180 to 240 cc. (6 to 8 ounces) of water three times daily, the stomach being empty; two hours after each dose, 4 to 8 grams (1 to 2 drams) of the magnesium sulphate are to be taken; after this dose an ordinary meal.

This treatment is designed to dissolve the lead deposited in the tissues and cause its elimination by the mucus of the alimentary canal in part, and to a slight extent also by the urine. The magnesium sulphate tends to remove such lead as finds its way into the alimentary canal with all possible rapidity. These measures, together with the removal of the patient from further exposure, exert of themselves a favorable influence upon the

malnutrition and anæmia. Quinine, strychnine, iron, cod liver oil may be advantageously administered as the toxic effects of the lead pass away.

The colic demands the administration of opium or its derivatives to relieve the pain, which is commonly excruciating. For this purpose the hypodermic injection of morphia is our most efficient remedy.

For the relief of the local paralytic affections, local as well as general treatment is necessary. Massage is of great use, especially when combined with passive movements. Galvanism, one large electrode being applied to the cervical vertebræ, the other to the extensor surface of the affected limbs, is followed with excellent results. Labile currents of fifteen or twenty cells should be thus applied, the poles being changed several times at each sitting. As the nutrition of the muscles improves, faradic currents may be occasionally substituted. Persevering treatment is necessary to obtain the best results.

For the present relief of the arthralgia gentle frictions, with or without anodyne liniments, must be employed. The hypodermic use of morphine may become necessary in cases in which the pain is urgent. It is, however, here as elsewhere to be, if possible, avoided. The tendency to recurrent joint-pains rapidly disappears as the poison is eliminated from the organism.

For the relief of the severe cerebral symptoms which are described under the term encephalopathy special treatment is of little avail. All observers agree in recommending an expectant plan. The measures of treatment directed against the general condition, as above described, must be steadily continued. The influence of chronic lead poisoning upon pregnancy is very deleterious. Constantine, Paul and others have shown that the early death of the foetus very constantly occurs. The prompt removal, of women who have become pregnant, from all exposure to lead, and energetic medicinal treatment are needed to obviate the danger of abortion.¹

IV. CHRONIC POISONING BY ARSENIC.

The frequency of poisoning by arsenic has greatly diminished in recent years. The acute forms whether accidental, as the result of the use of arsenic as Paris green for the destruction of insects or white arsenic as ratsbane, or suicidal or homicidal in consequence of its accessibility as a household destroyer of vermin or by reason of the comparative ease with which it formerly could be procured, are far less common. The chronic forms as industrial diseases affecting the worker, sometimes the ultimate consumer and often both, are even more infrequent. This fortunate change is the result of several causes, chief among which are a general diffusion of knowledge concerning arsenic as a poison; the incriminating character of the symptoms attending fatal poisoning; the agonizing suffering, and the uncertainty when taken for the purpose of self-destruction; the general enactment of

¹ A System of Medicine by American Authors. Courtesy of Lea & Febiger, Phila., Pa., and New York. Vol. V.

ordinances regulating the sale of arsenic in large quantities; and the use of less-dangerous substances for the purposes in which it was formerly largely employed in the arts.

It is a remarkable fact that at the present time one of the chief causes of chronic poisoning by arsenic is the result of the incautious or unduly prolonged exhibition of arsenical preparations for remedial purposes by practitioners of medicine.

The principal occupations which involve the risk of chronic arsenical poisoning at the present time are the mining and smelting of arsenical ores, and of silver, zinc and lead ores which contain arsenic, taxidermy, the manufacture of hats, and the making of certain dyes.

Prophylaxis.—Chronic poisoning, as an industrial disease, may be controlled by due attention to cleanliness in the workroom and of the person, the avoidance of taking food with unwashed hands, and the precautions necessary in all occupations in which the handling of poisonous substances is necessary. Among these ventilation is particularly important, and the inhalation of dust may be controlled by properly arranged fans.

Poisoning by the therapeutic use of the preparations of arsenic chiefly occurs in the ambulatory cases, especially those in which the manifestations consist of lesions of the skin and are not disabling. When the nature, variety and course of these forms of dermatitis, the chronicity of some of them, and the obscurity of their cause are considered, it is no matter of surprise that the patient may often fail to realize the true condition and continue, without reporting to his physician, to take indefinitely the prescribed remedy which is actually at fault. In this way, a new and a serious chronic disease is added to that for which the arsenic was prescribed. For this reason the patient should be advised of the necessity of reporting for examination at proper intervals. In the case of uncertainty, arising from ignorance on the part of the patient, it is important to take effective measures to prevent the renewal of prescriptions for the preparations of this drug.

Treatment.—The symptoms vary according to the dose of the poison; its mode of access to the body; the duration of exposure to its action; and the tolerance of the individual subject. While the withdrawal of the poison is of primary and fundamental importance, the details of the medical management of particular cases must be adjusted to the special circumstances of each case.

Acute Arsenical Poisoning.—The most common source of this form of poisoning is arsenious acid or white arsenic. This, in one of its forms, is white and opaque like flour, for which it has occasionally been mistaken. Being without color and without taste when quickly swallowed, it has been mixed with food for criminal purposes. In acute poisoning, the appearance of symptoms occurs usually in about one hour, sooner if taken when the stomach is empty; later after a full repast. Burning pain in the throat and epigastrium is followed by urgent vomiting and severe purging at first

fæcal; later serous and frequently bloody. In many respects the gastro-intestinal symptoms resemble cholera, with which this form of poisoning has been often compared. There is intense thirst but fluids are immediately rejected. There is profound collapse with its characteristic phenomena. Cramps in the abdominal muscles and calves of the legs add to the sufferings of the patient, who retaining consciousness almost to the end, soon passes into coma and dies. Less frequently the nervous system bears the brunt of the attack, and death occurs without the occurrence of the usual gastro-intestinal symptoms. In homicidal cases, smaller doses are sometimes mixed with food at intervals, and the toxic manifestations are referable to the acute and chronic effects of the poison.

The stomach should be washed out, a soft rubber tube being used for the purpose. If vomiting has not occurred, an emetic should be given. While this is being done the freshly precipitated ferric hydrate should be given, which is a true antidote as it forms with arsenious acid a very insoluble compound.

This remedy may be immediately prepared by precipitating the tincture of the chloride of iron or Monsel's solution with magnesia. The precipitate is strained off and given in excess. Meanwhile castor oil or olive oil should be given, colonic lavage practised and the collapse treated with external heat, blankets, hypodermic injections of brandy and strychnine, and the pain controlled by hypodermic injections of morphine. Hypodermoclysis is indicated.

CHRONIC ARSENICAL POISONING.—All preparations of arsenic in full doses are gastro-intestinal irritants, but arsenic has an especial selective action upon the skin and nervous system when admitted to the body in small amounts continuously for long periods. While frequently administered for cutaneous affections, especially those of a chronic nature, with remarkable benefit, it is a common cause of various forms of *dermatitis medicamentosa* and almost every form of cutaneous lesion has been attributed by dermatologists to chronic arsenical poisoning. The list includes erythemas, papules, vesicles, urticaria, pustules, erysipelas, herpes, bullæ, petechiæ, furuncles, carbuncles, and ulcerative and gangrenous lesions. To these must be added, in the long-continued cases, pigmentation and keratosis. The last occasionally occurs upon the palms and soles, and not rarely undergoes malignant degeneration. It is said that exposure to an arsenic-laden dust is especially liable to cause the form of chronic poisoning in which cutaneous lesions are prominent, and that, for this reason, the cutaneous type is more common among miners—an explanation in which the access of dust by way of the mouth and nose is overlooked. Externally arsenious acid has no action upon the unbroken skin, but when applied to denuded surfaces or to moist mucous membranes it is a powerful caustic. The use of arsenical ointments by quacks, in the treatment of cancer and other ulcerating surfaces, has been followed by arsenical poisoning. In the year 1900, a widespread outbreak of "peripheral neuritis" occurred in England and Wales, which was found upon investigation to have been caused by arsenic present

in beer. This beverage was distributed by a number of different breweries all of which used glucose and invert sugar supplied by a single company. The source of the arsenic was ultimately traced to impure sulphuric acid, supplied by one firm of acid makers, which was used in the manufacture of the sugar. The symptoms were such that the epidemic was thought for a time to be beri-beri, and subsequently gave rise to a general review of the subject of peripheral neuritis of alcoholic origin. The occurrence of gastro-intestinal symptoms with puffiness about the eyes, slight albuminuria and hyalin casts, pigmentation or other cutaneous manifestations in a patient taking arsenic, or in any way exposed to arsenic, should, at once lead to the withdrawal of the poison. This should be followed by the administration of potassium iodide 0.3 gram (5 grains) in a glass of water before meals as an eliminant. There is, however, no specific available for the chronic cases. The lesions of the skin in most cases disappear gradually as the exposure to the poison is discontinued. If this does not occur, they should be treated in accordance with general dermatological requirements. The nervous symptoms are more persistent and demand, from their onset, rest in bed, the use of anodynes, an abundant, nourishing and readily digestible diet; later, massage, passive movements, and electricity. Finally, such hygienic measures and progressively increased active exercises as may be indicated to restore nutrition in the particular case.

V. CHRONIC POISONING BY MERCURY.

Prophylaxis.—The occurrence of chronic mercurial poisoning has become in recent years much less frequent among workers in the industries in which this metal is used. This is due to the influence of preventive medicine and the knowledge among employers of the economic importance of protecting the health of their employes. The proper construction of factories with cement floors and walls surfaced with materials permitting thorough and frequent cleansing, properly constructed ventilating systems and closely-covered containers for the storage of the metal are hygienic measures of primary importance. Equally important is personal hygiene. Workmen should habitually wear the hair closely cut and the face shaved, Hoods should be worn when practicable, and the hands, in especially dangerous work, protected by rubber gloves. The hands and face should be carefully washed before meals, and the use of chewing tobacco during the working hours forbidden. Frequent bathing should be practised and, at stated intervals, a Turkish bath taken. Upon the occurrence of ptyalism the work should be for a time discontinued. Alcoholic and other debilitating excesses should be avoided and as much time as possible spent in open-air occupations and amusements when not engaged in work with mercury. These measures are not only preventive; they are also curative when symptoms arise. At the same time, water should be freely drunk and small doses of potassium iodide taken as an eliminant.

Treatment.—In addition to the above preventive and curative steps, which experienced craftsmen take of their own initiative, and with good results, medical advice frequently becomes necessary for special symptoms, especially the tremor and the emotional manifestations which some times arise in the absence of the usual and more obvious evidences of the real nature of the disease. The recognition of the cause of such symptoms is, as a rule unattended with difficulty when the occupation of the patient is known. Discontinuance of the harmful work and the use of potassium iodide are necessary in all cases. It may also be necessary to use nervous sedatives as chloral, the valerianates, the bromides, minute doses of hyosine hydrobromide or the derivatives of opium. There are cases in which the practitioner may avail himself of the combined sedative and eliminative action of tolysin, or in which the condition of the mouth and peridental tissues, as determined by röntgenographic examination, renders the intervention of the dentist necessary.

VI. CHRONIC PHOSPHORUS POISONING.

The occasional occurrence of acute phosphorus poisoning by swallowing match heads with suicidal intent or for the purpose of producing abortion, and the accidental poisoning by young children who swallow them in their play, calls for some words concerning the management of such cases. The importance of the subject arises from the fact that, taking the cases treated early and those coming under treatment late or moribund together, general statistics show a mortality of slightly over fifty per cent.

When the patient comes under observation soon after taking the poison, the stomach must be washed out with solutions of some chemical substance having the property of forming the comparatively harmless oxides of phosphorus. The more available and easily procurable of these are potassium permanganate 1 to 2000, hydrogen peroxide 1 to 3 per cent., or copper sulphate 0.13 to 0.3 gram (2 to 5 grains). The last acts not only as an emetic, but also forms a coating over the match heads, preventing, to some extent absorption of the phosphorus, which they contain. If it can be procured, old French or oxidized oil of turpentine should be given in emulsion, in doses 0.5 cubic centimeters ($7\frac{1}{2}$ minims) several times during the first hour and at longer intervals later. Fatty substances, which render phosphorus soluble are dangerous. The graver subsequent symptoms call for the free administration of water with glucose, and the control of vomiting by hypodermic injection of small doses of morphine, or small doses of cocaine by the mouth. Acidosis may be controlled by alkalis by the mouth, rectum or hypodermoclysis, and these failing, intravenously under suitable precautions. Colonic lavage should be used to relieve bowel stasis and remove products of intestinal fermentation.

Chronic phosphorus poisoning is an industrial disease which dates from the first use of phosphorus in the manufacture of matches, about the third

decade of the last century. The disastrous effects upon the workmen aroused widespread interest in the countries of Europe and led to the enactment of laws controlling the processes. Among those were the prohibition of the use of the poisonous white or yellow phosphorus, better planned and ventilated factories, the use of machinery to take the place of handwork, general attention to the personal hygiene of operatives, and scrupulous cleanliness in every respect. Where the foregoing regulations are carried out, particularly where red phosphorus is exclusively used in the making of matches, chronic poisoning does not occur. In fact, so infrequent are the cases at the present time in most of the countries in which matches are manufactured, that the disease has become practically unknown.

Prophylaxis.—In addition to the foregoing measures, the condition of the mouth and teeth must be regularly inspected, and upon the appearance of local disease the subject must be at once removed from further exposure and placed under medical care.

Treatment.—This consists of suitable dentistry which controls the milder cases. If, however, the trouble does not yield and necrosis devolves, early resection of the jaw is necessary and is frequently followed by an arrest of the process. But in severe and rapidly advancing cases extensive removal of the structures involved may not arrest its progress. Cases have been reported in which necrosis has first developed a long time, even years, after the patient has ceased to be exposed to the dangers of working in phosphorus.

VII. CARBON MONOXIDE POISONING.

As a basis for therapeutic studies, Yandell Henderson formulated these data:¹ 1. The whole effect of carbon monoxide is due to its combining with hæmoglobin and excluding oxygen. 2. Its combination with hæmoglobin is entirely and readily reversible. Red cells which have taken up a considerable percentage of their capacity for carbon monoxide and given it off again are as good as before. Therefore, the treatment hitherto employed, with the view of stimulating the formation of new red cells by bleeding and the infusion of saline solution, lacks logical foundation. In asphyxiation by carbon monoxide, the increasing oxygen deficiency causes a corresponding increase in the volume of air inspired. While this augments the absorption of gas it also, as Haggard and Henderson recently demonstrated,² washes carbon dioxide, which is the normal respiratory stimulus, out of the body. The fatal termination occurs when the blood fails to carry carbon dioxide to the respiratory center.

When the subject is removed to the fresh air, he remains comatose; the respiration is very feeble and shallow, and very little carbon monoxide is eliminated. At this stage the carbon dioxide, diminished by the earlier hyperpnœa, gradually reaccumulates and the respiration improves, and, in consequence of the loss of alkali which attended the loss of carbon dioxide,

¹ *Jr. A. M. A.*, Aug. 19, 1916, 580.

² *Jr. Biol. Chem.*, July, 1921.

may become again excessive. The restoration of alkali must come from the body itself, and not until the normal balance of carbonic acid and sodium bicarbonate is restored, does the respiration approach the normal. When, however, in the laboratory 8 to 10 per cent. of carbon dioxide is added to the oxygen, the breathing quickly becomes normal or more than normal; the mass oxygen in the alveoli displaces the carbon monoxide from the blood; the carbon dioxide alkali balance is restored; and the dogs subjected to the experiments are in the course of a quarter of an hour or so virtually restored.

These laboratory researches, conducted with great scientific precision and skill over a period of several years, have apparently solved the problem of carbon monoxide poisoning. What is now needed is the transference of the results from the field of research to the field of practical application.

Wherever asphyxiation commonly occurs, at fires, upon bathing beaches, at mines, there should be the apparatus and those having knowledge and training to use it and at once. "There are marked differences between the resuscitation from water asphyxia and the resuscitation from carbon monoxide asphyxia, but in each the objects are the same—the elimination of the asphyxiant, supply of oxygen to the blood and tissues, and restoration of breathing." (Haggard and Henderson, 1921).

The apparatus comprises a good inhaler, an easily adaptable mask and valves, a cylinder of oxygen containing 8 per cent. carbon dioxide, blankets and the like. These should go with the ambulance and fire patrol, and be at the rescue stations on beaches and at mines. There should be at hand persons who fully understand the use of such appliances, the handling of such cases and artificial respiration, of which the best method is that of Schafer, in which the patient lies prone, with the face turned to the side, so that the mouth and nose are free.

VIII. POISONING BY PETROLEUM DISTILLATES.

Various mixtures of the lighter liquid distillates of petroleum used in all parts of the world for illuminating purposes under the name of kerosene, coal oil or mineral oil, and for automobile engines as gasoline, petrol, naphtha, and so on, in volatilizing cause toxic symptoms especially in small closed apartments as garages or the engine rooms of yachts or other craft when used as fuel for motors. These fluids are occasionally accidentally swallowed. Gasoline, when used as a wash, may also give rise to severe, even fatal poisoning. The symptoms in the acute cases are intense burning in the mouth and epigastrium; vomiting; purging, with oily stools; collapse symptoms, as coldness of the surface, feeble pulse, cyanosis, anxious facies; intense thirst; restlessness, followed by loss of consciousness. In the cases due to repeated or prolonged inhalation of an atmosphere containing these gases, the symptoms develop more gradually. They are mostly nervous and comprise dysphagia, headache, vertigo, cyanosis and impairment of consciousness, sometimes passing into coma and terminating in death.

The diagnosis rests upon the history of the case and the odor of the breath and vomited matters.

The treatment consists in the prompt evacuation of the stomach when the poison has been ingested. This may be best produced by the stomach tube, which serves also for complete and repeated gastric lavage. In the absence of such an instrument, an emetic must be given of which the better are mustard water, syrup of ipecac or zinc sulphate, followed by warm water, and repeated if required. Cardio-respiratory stimulants such as spirit of ammonia, alcohol in small doses in the form of whisky or brandy, and atropine, caffeine or epinephrin hypodermically, enemata of strong coffee, general friction, external heat, blankets and artificial respiration are indicated. Finally, opiates are to be given to control restlessness and relieve pain.

The prognosis, when treatment is instituted early is favorable; in neglected cases very uncertain.

IV.

THE TREATMENT OF FOOD POISONING.

J. C. WILSON.

THE cases may be grouped under three principal headings: 1. Poisoning or gastro-intestinal disease caused by foods inherently poisonous. 2. Illness from foods contaminated by bacteria. 3. Toxic symptoms from foods impregnated with poisonous chemical substances. The largest and most important of these is the group due to the contamination of the food by specific bacilli. The most common bacteria are the important and distinctive series between the *B. typhosus* at one end and the *B. coli* group at the other—the paratyphoid-enteritidis or Gaertner group. These organisms are not found in the intestines under normal conditions, but they are important causes of disease both in man and the lower animals, and like *B. typhosus* they are present only in connection with actual disease or in the carrier state. They are destroyed by exposure to a temperature of 60° C. for thirty minutes; but their toxins are to a high degree heat-resistant, a fact which explains the outbreaks of food poisoning from this cause, in which the substances eaten contain no living bacilli of this group.

With reference to the action of specific bacilli in putrefaction and the part played by ptomaines or the other products of decomposition in food poisoning, Savage (1920) concludes that "tainted food is universally suspect, possibly quite justifiably suspect, but neither the degree of its malevolence nor the precise cause of its harmfulness has been placed upon a scientific foundation." Elsewhere, in his admirable book, this author dwells upon the unjustifiable popular and professional use of the phrase "ptomaine poisoning"¹ as an explanation of acute gastro-intestinal symptoms.

¹Food Poisoning and Food Infections. Cambridge. At the University Press, 1920.

The presence of ptomaines in organic matter can only be determined by an elaborate chemical procedure, and when found their toxicity should be tested by injection and feeding to laboratory animals.

The articles of food most commonly causing food poisoning are meats, fish and all kinds of shell-fish, milk and milk products, the poisonous fungi which are mistaken for the edible varieties of mushrooms, canned foods and various vegetables eaten raw. An examination of the literature of the subject shows that in a majority of the outbreaks the poisonous food was procured, served and eaten by persons who were not only ignorant of the danger they were incurring, but who were also so lacking in a fastidious sense of self-preservation, as to partake more or less heartily of food which was commented upon as of an unusual and often of an unpleasant appearance, taste or odor. In other cases, nothing objectionable was observed. In many of the reported cases, after a period of incubation varying from a few hours to a day or more, the occurrence of symptoms was explosive, many cases falling suddenly ill about the same time and fatalities occurring in rapid succession, before there was opportunity and time to ascertain the real nature of the cause. Under such circumstances prophylaxis was impossible and treatment merely symptomatic.

Prophylaxis.—Food poisoning is a matter which deeply concerns the public welfare, and every suspected case and all local outbreaks should be at once reported to the health authorities. In this way only can the nature of the particular toxic substance be ascertained and the source of its supply determined. By this means alone can its further distribution be arrested and the faults of supply controlled. It is fortunate that an increasing knowledge of the nature of food poisoning and an increasing efficiency in administration on the part of health officials has already to some extent diminished the dangers, but much remains to be done to save the eater from “death in the pot.” Among the essential facts to be ascertained in cases of meat poisoning are evidence concerning disease in the animals supplying the food; evidence as to the infection of the meat or internal organs subsequent to slaughter; the sources of infection, and the actual mode by which infection of the food has taken place.

Treatment.—In cases suggestive of food-poisoning, gastric lavage with warm water containing boric acid, a tablespoonful to a gallon, or sodium bicarbonate in like proportion, should be repeatedly practised until all food present has been removed. If the retching is such as to prevent the use of the tube, warm weak solutions of sodium bicarbonate and sodium chloride should be swallowed. The resultant vomiting will remove the stomach contents. Magnesium sulphate, as soon as it can be retained, should be given as a cathartic, and pending its action, colonic lavage administered, and repeated. Tablets of calomel, 0.0065 gram ($\frac{1}{10}$ grain) may be given at hourly intervals, and when thorough evacuation of the contents of the stomach and intestines has occurred, pain, distress and agitation should be relieved by the hypodermic injection of morphine. The symptoms of shock should be treated in the same manner as traumatic shock by artificial heat

to the extremities, hot water gastric and colonic lavage, the hypodermic injection of camphor, caffeine citrate and epinephrin. In extreme cases transfusion may be the means of saving life. During the acute symptoms, nourishment should be withheld. After two or three days, water ices or the best of the commercial baby foods may be permitted. Meanwhile barley water or toast water may be given to relieve thirst, or iced champagne, if it can be procured.

The treatment of botulismus and various forms of fish poisoning should be conducted upon similar lines.

BOTULISMUS.—The symptoms of botulism are characteristic and differ from poisoning by organisms of the paratyphoid-enteritidis group in that they are chiefly referable to lesions of the central nervous system. In the words of Van Ermengem (1912) "the symptoms of botulismus are so uniform and true to nature that, for the recognition of the disease, clinical appearances alone are sufficient." The symptom-complex comprises sensations of constriction of the throat, dysphagia, aphonia, paresis of tongue, membranous coating of the mouth and pharynx, urinary derangements, either diuresis or anuria, and constipation. More constant and important from the standpoint of diagnosis are the ocular symptoms—ophthalmoplegias, internal strabismus, nystagmus, paralysis of accommodation, mydriasis. In the gravest cases progressive bulbar paralysis shows itself in increasing respiratory and cardiac failure.

Fever does not occur; vomiting and diarrhoea are infrequent and transitory and consciousness is, as a rule, not impaired. The incubation period varies from twelve to twenty-four, even forty-eight hours. The mortality varies from 30 to 60 per cent., and the fatal termination usually occurs in the first or second week. Outbreaks have followed the eating of various kinds of sausage, ham, smoked and canned meats, raw and salted fish, and canned beans and asparagus. The disease is not common, but occurs with greater frequency in Germany than elsewhere and appears to be somewhat prevalent in the United States, especially upon the Pacific Coast. The American outbreaks have in a number of instances been traced to home-canned vegetables or fruits.

The prophylaxis of botulism consists in the use of clean and sound materials in the making of sausages and other forms of prepared foods, in the use of a strong brine—10 per cent.—in the preservation of meats and fish, and in the thorough cooking of foods liable to be infected during the process of preservation and immediately before they are eaten.

B. botulinus developing in various foods, whether animal or vegetable, produces gas, makes solid articles soft and mushy, and develops a foul taste and a rancid or even putrefactive odor. The natural acidity of fruits prevents the usual formation of toxins, but canned fruits in which the acidity has been neutralized permit their development. Green olives are too acid to serve as culture media for the organisms, but they grow in ripe olives, which, as bottled, are neutral in reaction. Articles of food which come under suspicion by reason of any indication of changes,

such as are caused by *B. botulinus*, must be thoroughly boiled and then thrown out. If the precaution of cooking be not taken, chickens and pigs eating such garbage containing botulinus toxin may be poisoned. Such articles of food must not be tasted. The greater danger in home preserving as contrasted with factory canning, consists in the failure to cook the food at a sufficiently high temperature—over 120—and a long enough time—10 minutes or more—to destroy *botulinus* and its toxin.

There are two strains, A and B. Type A is more common in foods packed in the West; B in the East. Each has its toxin; both are extremely virulent. In theory a polyvalent antitoxin is indicated. But the circumstances under which this form of food poisoning usually occurs makes the timely employment of antitoxin difficult. Considerable time must generally elapse after the diagnosis of botulismus is made before the antitoxin can be procured and administered. But such obstacles must, if possible, be overcome in the effort to save life.

SPECIAL FORMS OF FOOD-POISONING.—Mussels become poisonous from the presence in them of chemical poisons elaborated by bacteria in sewage contaminated waters in which they are grown. There is no definite scientific knowledge of the special bacteria. Whether the toxic principles active in mussel poisoning are due to the base, isolated by Brieger and called by him mytilotoxin, or to some other bacterial poisons is uncertain. The older opinions ascribing the outbreaks to copper poisoning, the mussels being eaten while spawning, star-fish spawn, or substances caused by changes in the mussels too long out of water or decomposed, lack scientific support as a basis for any general explanation of this form of food poisoning, although they may be adequate to account for individual cases or occasional limited outbreaks.

Oysters are a common cause of circumscribed outbreaks of typhoid and paratyphoid fever, and individual cases of acute gastro-intestinal sickness are often attributed, sometimes correctly so, to the eating of raw oysters not in good condition. Considering the conditions under which oysters are grown in polluted waters and the great quantities of them eaten raw or but lightly cooked, it is remarkable that so few cases of poisoning are traced to them. Other shell fish—crabs, shrimps, lobsters—that grow in brackish water and often under circumstances which favor sewage pollution, are frequently incriminated as causing acute gastro-intestinal catarrh. That such a causative relation is not more frequent is a matter of surprise. In many instances it has been found that the meat in question has been canned, or that some portion of the dishes prepared from it have been left over and eaten the following day or even later, without precaution to preserve it against infection.

Fish.—Fish poisoning may arise in various ways. Certain fish, especially in the tropics, are not edible or become so shortly after being caught. Others are thought to be infected by pathogenic micro-organisms peculiar to them, and to be toxic at the time, although at other times their flesh is palatable and wholesome. Fish poisoning, as a rule, results from

improper care of fish until it is marketed, and from contamination by fishermen, dealers, cooks and others who handle it before it reaches the ultimate consumer.

Milk.—As an article of food of universal consumption, milk plays a most important part in causing and transmitting disease. The especial characteristics which render it potent as a distributor of infection are:

(a) It is very generally consumed in the raw state or at varying periods after pasteurization. If kept too long after being thus treated, it may become infected.

(b) It is an excellent nutrient medium for bacterial growth.

(c) It constitutes the chief food for babies and young children.

(d) It requires much handling at the dairy and in distribution, and is thus greatly exposed to the danger of infection, notwithstanding stringent regulations on the part of the health authorities.

(e) The animal source from which it is obtained is liable to various infections.

Frequent and extended outbreaks of infectious diseases are clearly traceable to milk. They are usually linear in distribution, following the route of a particular dairyman from house to house and back again to the source of supply. The infectious diseases often milk-borne are tuberculosis, enteric fever, paratyphoid fever, scarlet fever, diphtheria, forms of tonsillar angina, gastro-intestinal disorders and food poisoning from the Gaertner group of bacilli. Any disease that is water-borne may also be milk-borne, and cholera, dysentery and Malta fever belong to this category. Most of the diseases thus disseminated by milk are the result of specific infection directly or indirectly from human beings; but tuberculosis, Malta fever, foot-and-mouth disease, forms of sore throat and specific food poisoning are derived from the diseased animal. The infection of the milk may be direct from any person engaged in handling milk, who is suffering from a specific infection at the time, or convalescent, or a "carrier," or it may be indirect as from water used in the dairy, or by way of dust, flies or infected utensils or clothing. Very extensive outbreaks of enteric fever have followed the wanderings of carriers who have acted as cooks. The crystalline poisonous body described by Vaughan and called by him tyrotoxinon has been found in milk and milk preparations, especially cheese, and by many other observers in the older and more recent outbreaks, but it has been frequently absent in serious local epidemics. It cannot therefore be regarded as the sole or even the common cause of specific "food poisoning" by milk.

Cheese poisoning and poisoning by other products of milk, as ice cream, cream puffs and similar articles are of not infrequent occurrence, but fortunately fatalities are rare. The outbreaks do not differ in essential particulars from those caused by other foods improperly prepared or preserved, and do not therefore constitute a special group.

Potatoes as a cause of poisoning, long attributed to solanin produced at the time of sprouting, have been shown, in more recent scientific investigations, not to produce sufficient solanin to cause actual poisoning, unless at

least one kilo were to be eaten and the whole amount of solanin in it absorbed. Moreover, in many of the reported instances the potatoes were peeled or prepared as salad, and eaten after standing exposed until the next day. The skin is a protective against bacterial infection and when this has been removed, the potato is an excellent nutrient medium for bacterial culture. Under these circumstances, it is probable that the outbreaks in question were due to bacterial infection rather than to the chemical solanin.

Mushrooms.—There has been much uncertainty in regard to the subject of poisoning by these fungi. Most of the cases have occurred in children and young persons who have eaten poisonous fungi, which are usually rejected, and for this reason poisoning is more common in the country than in cities, where the inspection is usually made by experts who are more critical. There is, however, a well-known instance in which a gentleman, who had acquired a wide reputation as having a scientific knowledge of the subject, was fatally poisoned by eating mushrooms, which he had, personally, purchased in the open market.

Muscarin, a powerful poison acting upon the nerve centers, has been isolated from *amanita muscaria*. This substance produces symptoms in the human subject which are not identical with those caused by the fungus itself. It may therefore be assumed that while muscarin plays an important part in poisoning by this mushroom, it is probably associated with other poisonous principles which have not yet been investigated. Poisons causing degenerative processes in the internal organs have been obtained from the *amanita phalloides*. A powerful hæmolytic body called phallin was, for a long time, regarded as the chief of this group. Ford, however, in 1906, obtained two toxic substances one of which he called *amanita-hæmolysin*, the other a-toxin. The first of these being destroyed by heat, as in cooking, and by the action of pepsin and pancreatic juice, Ford and Bronson (1913) regarded as of little importance in fungus poisoning. They found the latter, a-toxin, resistant to the action of heat and the digestive ferments, and capable of causing symptoms in animals identical with those in man, and regard it as among the most powerful vegetable poisons. This is in accordance with the fact that this fungus, after cooking, remains extremely poisonous to man. Whether or not the more intense and directly applied heat in broiling would destroy the poison is unknown. It is probable that edible mushrooms are sometimes rendered dangerous by parasitic fungi which are poisonous in themselves or produce poisons in the host. It is a matter of surprise that mushroom poisoning is not more common, in view of the extremely toxic nature of some common varieties of poisonous fungi, and the great difficulty in distinguishing between those that are deadly and those which are edible.

Prophylaxis.—There is no absolute rule of safety. The only way to be safe is not to eat mushrooms. There are various popular tests but they are all fallacious. If mushrooms are eaten at all, it should be shortly after they are gathered, and each one should be examined to see that it is sound

and free from parasitic growths. They should be thoroughly cooked and broiled, which involves direct exposure to a much higher heat, in preference to stewing. They should be well chewed to secure prompt digestion. There should be no serving of those left over for a subsequent meal.

Treatment.—The immediate treatment should be symptomatic, evacuant and eliminant. Emetics and purgatives are important; later, if necessary, gastric and colonic lavage. The indiscriminate practice of administering large doses of atropin hypodermically is not to be recommended. This plan should be restricted to those cases in which symptoms, such as contraction of the pupils, salivation, slow pulse and collapse, clearly point to poisoning by muscarin. In other forms atropin may be harmful. Profuse diarrhœa should be treated by morphine.

Food Poisoning by Chemical Substances.—Certain metals and their salts present in articles of consumption may give rise to poisoning. As a rule this kind of poisoning occurs insidiously and is chronic. The more common forms are caused by arsenic in beer which, in consequence of the varying dosage and duration of time in which the beer is consumed, and individual peculiarities as regards age, sex, habits and the coexistent alcoholism presents variable symptoms; or in sugar plums either in some ingredient or in the shellac with which some of the cheaper confectionery is coated or which is used as a varnish for the containers. The insecticide solutions used in spraying fruits and vegetables mostly contain arsenic and may become the source of poisoning in those who habitually eat such articles. The smaller fruits, having a relatively larger surface, are rendered by this means more poisonous; and it is said that half a pint of strawberries may contain as much as 8 mg. of arsenious oxide. In this way green vegetables used as salads, if not carefully washed, may carry an amount of poison capable of producing in time toxic effects. Quite recently, arsenic has been found in baking powder.

Antimony is widely distributed in nature and has been found in rubber goods, especially in the rings used for mineral water bottles. Poisoning by antimony has not, however, been reported.

Lead is present in considerable amounts in the enamels used in glazing the earthenwares used in cooking; in tin foil used in wrapping chewing tobacco and tea; lead shot have been largely employed in cleansing wine bottles and lead is present in the metal valves in siphons and in the vats used in the manufacture of cider. Notwithstanding the common presence of this metal in articles used in the preparation of food, lead poisoning is not often traced to this cause.

Copper occurs in foods in small quantities but rarely in sufficient amounts to cause toxic symptoms. It forms upon the surface of utensils the greenish-gray crystalline chemical deposit known as the basic acetate of copper, and in popular parlance as verdigris. But the appearance of this deposit and the popular dread of its poisonous properties constitute efficient safeguards against any real danger from it. The copper present in certain

oysters in the form of cupric oxide, in quantities too minute to make them dangerous when eaten in ordinary quantities, imparts to them a distinct metallic taste.

THE CONTAMINATION OF FOOD BY THE CONTAINERS IN WHICH IT IS PRESERVED AND MARKETED.—The foods thus treated are mostly condensed milk, all kinds of meats and meat foods, fish, shell-fish, vegetables and fruits; the container cans made of tin-plate. The advantages of these containers are manifold. They can be heated to a high temperature and when the contents are sterilized they can be soldered. They can be more readily packed and transported and occupy less space than glass or earthenware of equal capacity. There has been, however, a growing prejudice against "canned goods" and this has gone so far that the contents of cans have been emptied into glass bottles and relabelled for the home market. Any actual danger from the tin container, which is in fact not great, is not obviated by such an exchange.

The metals, and their salts which contaminate foods preserved in cans, are iron, lead and tin. The first is actually harmless, and the quantity of the second so minute that it also is practically harmless. Tin is of importance in proportion to the amount present. This proportion depends upon the nature of the food, the length of time it has been in the can, the quality of the tin, the solder and the concentration of the tin.

Practically all canned foods are contaminated to some extent by the tin of the container. The natural acidity of meats, meat extracts and essences, peaches, cherries, pears, plums, pineapples, asparagus, and tomatoes acts upon the tin. It is important that in the case of foods consisting of solid and fluid portions, after a time the solids contain proportionately more tin than the fluids, and that the tin tends to be present in an insoluble form.

Duration of time since the food was canned has some bearing upon the amount of tin, which gradually increases. With acid foods the increase of tin is more rapid at first than at a later period. Theoretically there is greater danger in the use of lightly coated cheap tins, but practically it was found upon critical investigation that none of the difficulties, as perforation of the cans, discoloration of the cans or contents, or amount of tin were eliminated by heavy tin coatings.¹ When solder containing both tin and lead drops into the can, the solution of tin is noteworthy. With contents of the same kinds of food a greater solution of tin takes place under such circumstances in a few months than in several years with a properly soldered can.

The general conclusion is that the amount of tin ingested upon a diet consisting largely of canned foods and continued over considerable periods of time is not attended by serious risk of chronic poisoning; and that the literature does not contain reports indicating that tin plays any part of importance in connection with acute or chronic food poisoning.

¹ "Relative Value of Different Weights of Tin Coating in Canned Food Containers"—1917.

V.

THE TREATMENT OF AUTOINTOXICATIONS.

SAMUEL BRADBURY.

THERE are several rather unusual disease conditions in which symptoms arise because there appears to be retention of one of the usual body wastes, or because there is such interference with the normal metabolism of food or of body tissues that toxic products are formed. It is conceivable that such poisoning may occur from gastro-intestinal disorders, from renal or hepatic disease, from interference with the function of the skin, and from abnormal metabolism of the three classes of foodstuffs, protein, fat, and carbohydrates. Of the latter group of disorders something is known, and has been discussed under the treatment of gout and diabetes, and of the acidosis associated with diabetes. Of the former group one retention disorder, uræmia, is discussed under nephritis. Of the toxæmias associated with advanced liver disease or with extensive destruction of the skin, comparatively little is known; and treatment is unsatisfactory because a vital organ is so destroyed that any function is impossible.

The theory that disorders of the gastro-intestinal tract produce toxæmia has been used to explain a multitude of complaints, but there is no proof that any of these is related in any way to the elaboration of a toxin generated in the stomach or intestines from either food, digestive ferments, or bacterial action. In a few rare instances the excision of a dilated stomach, or the correction of a partial obstruction of the intestine may clear up symptoms which appear to be associated with them. In other instances, the correction of chronic constipation will put the patient upon the road to health.

ACIDOSIS.

Acidosis is the one of the toxæmias of which at least a little is known. It appears to be due to a disorder in the metabolism of fat and to be usually associated with some toxin which acts upon the liver. In the adult it is usually encountered as a complication of diabetes mellitus, but rarely it is seen, in a non-diabetic form, in chronic nephritis, in chronic disease of the liver, and in Asiatic cholera. Acidosis is more frequently seen in children, either as an accompaniment of severe diarrhœa, or as a post-operative complication.

Prevention.—In diseases in which acidosis may develop, certain measures may be taken to prevent its onset.

Post-Operative.—The child should be given water by mouth as soon as is practicable after recovery from the anæsthetic. If vomiting prevent this, normal saline solution should be administered continuously per rectum. In a few instances, where feeding may be delayed for some days, sugar solution may also be administered by rectum.

When oral feeding is begun carbohydrate in some form should be administered early, and fats should be withheld until the intake of carbohydrate and of protein has assumed rather generous proportions.

Diarrhoeas.—The fluid lost by many copious bowel movements should be replaced, and the physician should watch the urinary output to make sure that the kidneys are active. When there is no vomiting, water may be administered by mouth. If the stomach is not retentive, saline solution should be administered by rectum or under the skin. The diarrhoea may interfere considerably with the rectal administration of saline but usually there will be considerable absorption of fluid during the rectal irrigations which are so frequently advised.

Treatment.—When acidosis has developed, early and adequate treatment is essential. The three important requirements are, an increased intake of fluids to keep the kidneys active in the elimination of the acid bodies, the administration of sugar to prevent the breaking down of the body fats, and alkali to neutralize the acid.

Water may be administered orally, by the continuous rectal drip, or in the occasional case as normal saline solution under the skin. The amount of fluid intake varies with the age of the patient, but it should be more than that ordinarily ingested.

Sugar is usually given by rectum in a five to ten per cent. solution by the continuous drip method. Glucose is the sugar which should be used.

Alkali is administered as bicarbonate of soda. Even when the child is vomiting persistently a solution of bicarbonate of soda, two teaspoonsful to the glass of water, may be frequently sipped and will often be retained. The bicarbonate may be dissolved in the solution of sugar in five per cent. strength and administered by rectum. A four per cent. solution has been administered intravenously, but will rarely be found necessary. The preparation of sterile intravenous solutions has been considered in the section on diabetes, and here it is only necessary to remark that bicarbonate of soda should not be mixed in hot water, or used after boiling, without treating it as has been suggested under diabetic acidosis.

By one or another method two to four grams of bicarbonate should be gotten into the child every two hours until the urine is alkaline; and then in amount sufficient to keep the urine alkaline for several days after acute symptoms have subsided. It is best not given under the skin, as the danger of necrosis is great.

The Diet.—As soon as the stomach is retentive, food should be given. At first it should be only cereals and sugar, the latter preferably lactose. With improvement, protein may be added, and when recovery is complete fats may be taken.

VI.

THE TREATMENT OF HEAT STROKE AND ELECTRIC STROKE.

SAMUEL BRADBURY.

EFFECTS OF HEAT.

THE differentiation of heat stroke (sunstroke), and of heat exhaustion is usually quite easy, and is important because the treatment of each condition varies radically.

Treatment of Heat Stroke.—Hyperpyrexia is the first indication for treatment of the average patient with sunstroke. The best method for its reduction is the cool bath. The patient is placed in the tub with water at about 80° F., and from time to time ice is added, gradually reducing the temperature of the water to 70° F. or even 60° F. During the tub the limbs and back should be constantly rubbed to assist in the circulation of the blood, so that it may be brought to the body surface and cooled. When the rectal temperature has fallen to 102° F. the patient is taken from the bath, dried, and put to bed. After several hours it may be necessary to repeat the hydrotherapy because the temperature will again become elevated, and in this instance a sponge bath of ice water may be all that is necessary.

In robust men with marked swelling of the veins of the neck and œdema of the lungs, venesection is usually beneficial, 500 to 600 cc. (16 to 20 ounces) of blood being withdrawn. In the cases which have a very sudden onset with intense symptoms, the bleeding should be practised at once.

For failing circulation, strychnine, caffeine or atropine may be used hypodermically. If there are repeated convulsions the patient should be chloroformed.

Treatment of Heat Exhaustion.—The patient with heat exhaustion appears as if he were in shock. The skin is cold and clammy, the temperature is subnormal, the pulse rapid and weak, and there may be unconsciousness. The patient should be put to bed, the clothing loosened about the neck and waist, he should be covered with a warm blanket, and hot water bottles or bricks placed at the feet. When there has been a marked fall in temperature the hot bath may be used to advantage. Stimulants should be freely administered, either ammonia by inhalation, or strychnine or atropin hypodermically.

ELECTRIC STROKE.

The treatment of burns caused by contact with an electrical current does not differ from that of burns caused by other agents. It should be mentioned that the destruction of tissue may extend to and involve the bone.

After the individual has been freed from contact with the current, and

it has been found that the heart is still beating, there is a possibility of saving life no matter what the other condition. If consciousness has not been lost the patient will usually recover in a few hours. With syncope, the patient should be laid flat upon his back, the clothing about neck and waist loosened, and the usual treatment for syncope carried out—inhalations of ammonia, cold water upon the face, sometimes the injection of strychnine or caffeine. If there is no breathing artificial respiration should be started at once and continued until the heart has stopped beating, or natural respiration is reëstablished.

The subsequent nervous manifestations will frequently gradually disappear. It is best however that they be under the care of a specialist.

VII.

THE TREATMENT OF PREGNANCY.

B. M. ANSPACH.

SINCE, in the treatment of pregnancy, the chief aim is to obviate trouble, being, therefore, prophylactic in purpose, the physician should from the very beginning, be thoroughly acquainted with the physical and mental history of the patient, both past and present. This would necessitate close inquiry and a thorough physical examination. With such information at hand, the treatment may be undertaken, having in mind any two or more of the following objects:

1. To lessen the annoyance incident to normal pregnancy.
2. To prevent normal pregnancy from becoming abnormal.
3. Actively to combat, and to treat when they occur, the accidents and toxæmias incident to pregnancy, and that take place in spite of prophylactic precautions.
4. To treat any intercurrent or complicating maladies that may attack the pregnant woman.

The first three of these objects have much in common and may be discussed together. The fourth may be dismissed with the brief statement that, in the pregnant woman, intercurrent or complicating diseases are prone to assume an exaggerated form; that in her condition the prognosis is generally graver than in the normal woman, and that premature interruption of pregnancy by reason of the death of the fœtus is more or less likely to occur. Such disorders should be treated as in the non-pregnant state, except that active purgation or the use of certain drugs, such as aloin or quinine, should be avoided whenever it is possible to do so without incurring harm to the patient.

The subject matter of the first three groups may be considered conveniently under two heads: (1) The management of pregnancy; (2) the treatment of the abnormalities of pregnancy.

The Management of Normal Pregnancy.

This includes a consideration of the following important factors:

1. **Diet.**—During the early stages of pregnancy the disinclination to eat, or even an actual aversion to food, with nausea and vomiting, may be relieved by taking small quantities of easily digested and nourishing food at frequent intervals. As the patient expresses it, she “feels better when there is something in the stomach.” Before rising in the morning a bit of toast and a cup of tea or of weak coffee or milk may be taken; later, and at two-hour intervals throughout the day, any of the following may be permitted: crackers or cereals, with cream or milk; broth with toast or crackers; a bit of chop with baked potato; a soft-boiled egg with dry bread, and the like. Acid fruits or vegetables, rich foods, shell-fish, pastry, hot bread, etc., should be avoided. After this early period of gastric disturbance, there often ensues a period during which the appetite is unusually good and the patient is likely to overeat. It is wise to acquaint the patient with the fact that additional intake is not required in order to sustain the growing foetus, and that no harm will come to her or to her baby as the result of taking a minimum amount of food, whereas much harm may result to both mother and child from taking too much food. The total quantity ingested, therefore, should be kept a little below what the patient desires. The suggestion that she leave the table before her appetite is fully satisfied will usually afford the desirable limitation. So far as the variety of food is concerned, the amount of animal food should be noted carefully and the bounds of moderation never be overstepped. A good working plan is to regard all food derived from other than vegetable and mineral sources in the same category, and to limit its intake to two or three portions a day. Thus, one egg, a bowl of soup made from meat stock, a helping of chicken or duck, or a piece of steak or a chop, may be regarded as equivalent in food value, and each considered as one portion. For example, an egg at breakfast, a cup of broth at luncheon, and one piece of fowl, beef, lamb, or other meat may be allowed at dinner. At breakfast bacon may be substituted for the egg, or both bacon and the egg may be taken at that time, thus consuming two of the daily portions; or any other plan may be followed that has in mind the object of limiting the intake of protein food. Later in pregnancy the number of portions of such food should be still further reduced, and for an additional reason, namely, to prevent overgrowth of the child. Milk may be permitted throughout pregnancy, but it should not be used in excess, since it tends to cause constipation and promotes excessive obesity of the mother and, in the last months, overgrowth of the child. Non-acid and especially stewed fruits, vegetables, and cereals should make up the bulk of the diet. Sweets may be permitted in moderation.

2. **Bowels.**—It is highly important that the bowels be moved thoroughly every day. Most pregnant women require laxatives. The following alone or in combination, may be recommended: Mineral (pure paraffin) oil, cascara, fluid or solid, phenolphthalein, a pill of cascara, rhubarb, and

podophyllin, milk of magnesia, and magnesium oxide. Occasionally an active saline purgative, citrate of magnesia, or well-diluted Pluto water may be used. Castor oil, compound cathartic pills, pills containing aloin, or any of the so-called laxative pills, the formula of which is unknown to the physician, should be avoided. In most cases the most satisfactory combination consists of mineral oil, 8 to 16 cc. (2 to 4 drams) with extract of cascara, 0.13 to 0.3 grams (2 to 5 grains) taken together every night. When there is hyperacidity, milk of magnesia may be substituted for the cascara; taken after meals it often renders other laxatives unnecessary. It is usually better for the patient to take the laxative daily, even though very little is required, than to neglect her bowels until constipation or indigestion demands a larger dose.

3. **Kidneys.**—Water should be taken freely, a specified quantity, as, for example, eight glasses a day, being prescribed. If the urinalysis shows a normal condition, reexamination every month during the first six months of pregnancy is sufficient; during the later months, however, a specimen of urine should be examined every two or three weeks. When abnormalities in the total amount excreted or in the constituents of the urine are noted, or when, for any other reason, such as previous disease of the kidney, high blood-pressure, etc., insufficiency is more likely to occur, urinary tests should be made more frequently.

4. **Exercise.**—This is important. The form that is the least harmful and most readily available to a majority of patients is walking. Active exercise, such as golf, tennis, dancing, swimming, etc., should be prohibited or restricted, depending upon the individual's inclination to overindulgence or her tendency to abort. Automobiling over rough roads, long and fatiguing rides, and driving should be forbidden because of the danger of inducing abortion. In this respect trains and trolleys are less objectionable than automobiles.

5. **Bathing.**—As the skin has an important excretory function, there is an additional reason during pregnancy for the daily bath. A warm bath, followed by a quick cold shower, is preferable. During the later months of pregnancy, tub baths should be omitted, or, at least, the patient should not sit in the water. Cleanliness should particularly be maintained about the external genitalia. Vaginal douches should be prohibited. The nipples should be washed only with Castile soap, and not oftener than twice a week.

6. **Air.**—An abundance of oxygen is conducive to the best interests of mother and child, and, for this reason, fresh air should be supplied at all times.

7. **Sleep.**—Efforts should be directed toward placing the patient under such conditions as to secure her the greatest amount of healthful sleep. If she suffers with insomnia, such stimulants as coffee and tea should be forbidden, and if her habits of life are such as to deprive her of the normal amount of sleep, she should be advised to alter her mode of living. In the later stages of pregnancy, when active foetal movements sometimes interfere with sleep, an occasional dose of sodium bromide at bedtime will usually be beneficial.

8. **Mental Depression.**—This is not unusual during early pregnancy, and is the result of the malnutrition or anæmia incident to the common gastric disturbances. Later in pregnancy, the anxiety incident to the anticipation of labor, and the disturbing information often so freely supplied by misguided acquaintances, may be responsible for mental unrest. The patient's mind should be directed into healthful channels; books or papers dealing with pregnancy should be forbidden, and the physician should frequently reassure his patient as to the excellence of her condition, and that labor is a normal process.

9. **Teeth.**—The teeth are in many cases unfavorably influenced, presumably from the deficiency of lime salts. To supply this demand calcium lactate may be administered regularly, and such articles of diet as oatmeal and whole wheat bread should be recommended. An antiseptic and alkaline mouthwash and a reliable toothpaste should be used regularly. A competent and non-meddlesome dentist should be consulted at the beginning of pregnancy, and as often during its course as he thinks advisable. Actual work on the teeth should, however, be postponed or reduced to a minimum until after delivery.

10. **The nipples,** as previously advised, should be washed with Castile soap twice a week, in order to prevent the accumulation of crusts. If the nipples are inverted or poorly developed, they may be pulled out gently with the fingers or by means of a breast pump every day during the last week of gestation. It is doubtful whether any of the solutions, lotions, etc., prescribed for hardening the nipples before labor do any good, whereas some of them may actually be harmful. A solution that may be recommended consists of sodium baborate, 15 grams, (4 drams) in equal parts of alcohol and sufficient water to make 90 cc. (3 ounces).

11. **Coitus** during early pregnancy should be limited, since there is a tendency in many instances toward excess. It need not, however, be restricted entirely, except for some special reason or if abortion is threatened. As pregnancy advances, however, there is a more or less natural disinclination for copulation, which should be encouraged to some extent; during the last month, or at least during the last two weeks, coitus must be absolutely forbidden.

12. **Abdominal support** is never required before the fourth or the fifth month, especially in primiparæ, and even in these it is often not required at all during the entire period of pregnancy. In many primiparæ and in most multiparæ, backache and dragging sensations in the lower abdomen may be alleviated by applying the right kind of a support. This may be afforded either by a maternity corset, or, preferably, by an abdominal binder. When the latter is selected, a brassiere or a breast support should be used in conjunction with the binder.

13. **Blood-pressure** during pregnancy is an easily determined and a valuable index of the patient's condition. The pressure should be noted at the first examination, and at least at monthly intervals thereafter. As a rule it gradually increases as the pregnancy advances. An estimation of both

the systolic and the diastolic pressure should be made, and the relationship of the pulse pressure to the systolic pressure should be noted: the usual ratio is as 1 to 3. If the pulse pressure is above or below this point, or if the systolic or the diastolic pressures are abnormal, stricter precautions than usual should be taken to anticipate renal, hepatic, or cardiac insufficiency. Speaking generally, the average patient in good physical condition will show at the middle of pregnancy a systolic pressure of 120 and a diastolic pressure of 80; this will gradually increase toward the end of pregnancy approximately to 130 to 135 systolic, and 85 to 90 diastolic. If the systolic rises to 140, and the diastolic to 100, or above these points, the physician must be on guard.

Low pulse pressure—systolic, 90–80, diastolic, 70–60—is encountered in the anæmic and weak, and is generally associated with other evidences of a failing circulation (*e. g.*, œdema of the extremities), and must be combated with circulatory stimulants, such as strychnia and digitalis. A rise in blood pressure and a disturbance in the normal ratio existing between the systolic reading and the pulse reading is often the first indication of impending trouble. It should, therefore, receive prompt attention, and be met with energetic action.

In addition to the regular conferences between the physician and his patient, the latter should be instructed to report immediately any of the following symptoms:

Diminution in the amount of urine excreted; an unusual vaginal discharge, or an increase in a previously existing one; any sudden gush of fluid from the vagina; vaginal bleeding; headache; dimness or disturbance of vision; œdema; obstinate constipation.

The Treatment of Abnormalities Occurring During Pregnancy.

The Toxæmia of Pregnancy.—The usual clinical picture presented by the toxæmia of *early* pregnancy is that of the so-called exaggerated or pernicious nausea and vomiting. The presence of this untoward symptom is not easily explained, but a rational hypothesis, and one that is borne out, in part at least, by the experience of the therapist, is that the toxæmia results from the deportation into the circulation of chorionic cells and their absorption. As the *corpus luteum* of pregnancy is intimately concerned with the nourishment of the early ovum, it was believed that *a priori*, its exhibition internally might prove beneficial in the toxæmia of early pregnancy, a theory that has been borne out by results. The remedy may be given in the form of lutein tablets or as a powder by mouth, or the liquid extract may be injected intramuscularly. It seems unquestionably to possess a beneficial or curative influence.

An important factor in the persistence of nausea and vomiting is the acidosis or acetonuria that sometimes follows the starvation attendant on this condition. This is best relieved by sodium bicarbonate, 2 per cent.,

given continuously or interruptedly by the rectum. When symptoms of actual acidosis are present, such as the characteristic odor of the breath, the peculiar hyperpnœa, the presence of acetone and diacetic acid in the urine, the entire appearance of the case may be quickly changed by giving an intravenous injection of one pint of a 2 per cent. solution of sodium bicarbonate. The solution must be prepared from sterile water and dry, sterilized sodium bicarbonate. Boiling after the solution is prepared should be avoided, lest a carbonate be formed. Combined with these measures nerve sedatives, such as the bromides or luminal, and regulation of the diet, as has previously been described, will usually be effectual. If the symptoms persist in spite of treatment, competent advice should be sought, and if in the opinion of the consultant the case appears hopeless, an abortion should be induced. One should not wait until the patient is *in extremis*. Frequent estimates of the alkali reserve in the blood and the application of the alveolar air test will often avert disaster.

The toxæmia of *late pregnancy* is a somewhat different matter from the toxæmia of early pregnancy. In the former condition renal or hepatic insufficiency is the etiologic factor, although other conditions probably play a part. The etiology is nevertheless, far from clear, notwithstanding the many efforts that have been made to throw light on the subject. The treatment, however, consists in stimulating the excretory organs—the liver, the skin, the kidneys, and the intestines—and in limiting the intake of food that places stress upon these organs. Cascara, rhubarb, and podophyllin in pill form, used regularly, will act as a mild cholagogue and stimulant. Hot packs and the use daily or oftener (every three hours) of the electric cabinet bath may be prescribed to promote the elimination of waste matters by the skin. Refrigerant diuretics, of which the most suitable is sodium citrate, may be exhibited in full doses 1.3 grams (20 grains) every three hours with a glass of water. The free action of the bowels daily may be assisted by prescribing a saturated solution of Epsom salts 8 to 16 grams (2 to 4 drams) every half-hour until thorough evacuation has taken place. These measures, combined with a diet of milk, green vegetables and rice, may be promptly effective. If they are not, the diet may be reduced to skim milk, or the patient may be sustained entirely by enteroclysis (2 per cent. sodium bicarbonate solution and 3 per cent. glucose). If the condition grows worse, as shown by persistent and peculiar epigastric pain, disturbance of vision, headache, diminution in the urinary output, the presence of albumin or casts in the urine, œdema, high blood-pressure, or symptoms of acidosis, abortion or premature labor must be induced.

Habitual Abortion or Threatened Abortion.—The most common cause of repeated abortion in women, otherwise healthy, consists of retroversion of the uterus. All pregnant women in whom such a displacement exists should be instructed to assume the knee-chest posture for five minutes followed by the Sims' position for twenty-five minutes, three times daily. The patient should wear no corsets during this time, and she must be taught to assume the positions correctly. Automobile riding and all active exercise should be

forbidden. Lutein tablets, 0.3 gram (5 grains), should be given three times a day. The patient should be instructed to figure out, with the aid of a calendar, the days of each month during which she would normally be menstruating if pregnancy did not exist. On those days she should remain especially quiet, taking very little if any exercise. Capsules of codein, 0.015 gram ($\frac{1}{4}$ grain), *ext. hyoscyamus*, 0.02 gram ($\frac{1}{2}$ grain) and *ext. viburnum opulum*, 0.3 gram (5 grains) should be prescribed and the patient ordered to take them upon the appearance of any indication of threatened or beginning abortion (*viz.*, uterine pain or bleeding) and while waiting for her medical attendant to come. As soon as he arrives, he should administer a hypodermic of morphine, 0.015 gram ($\frac{1}{4}$ grain), and atropin, 0.0004 gram ($\frac{1}{50}$ grain). Absolute rest in bed, scanty liquid diet, a simple enema every other day, and the sedative capsules as often as may be required to keep the patient restful and quiet should be prescribed.

Ilio-sacral Pain and Backache.—A well-fitting maternity binder will usually relieve pain in the back, sacro-lumbar or sacro-iliac joints, and upper part of the thighs. Firm strapping with adhesive plaster across the sacrum and from the line of one anterior superior iliac spine to the other, may assist in the treatment. The patient may also get relief by keeping off the feet, lying down instead of sitting, and the assumption of the knee-chest or the Sims' position.

Varicose Veins.—**Hemorrhoids.**—Varicose veins of the lower extremities call for rest, and this must be absolute if the veins become inflamed. Otherwise supporting the affected extremities with an elastic webbing bandage applied before rising in the morning, with frequent assumption of the recumbent posture, may be sufficient to keep the patient comfortable. Hemorrhoids are best treated by the frequent use of the knee-chest or the Sims' position, plus a daily laxative and the use of an astringent ointment (*ung. gallæ*, *ung. stramoni*, U.S.P., equal parts); if preferred, a mild astringent suppository may be prescribed. In both varicose veins and hemorrhoids a circulatory stimulant may be of decided value.

Edema of the Lower Extremities.—As œdema of the lower extremities may be due to simple pressure of the growing foetus upon the pelvic veins or lymphatics, or to circulatory weakness, both postural treatment (frequent assumption of the recumbent, knee-chest, or Sims position) and circulatory stimulants, such as strychnine and digitalis, may be prescribed. If the evidence points to renal insufficiency as the etiologic factor (albuminuria, casts, œdema of the hands or face, and the failure of postural treatment to benefit the condition), diuretics and regulation of the diet must be ordered.

Excessive Increase in Weight.—This must be avoided by strict limitation of the diet, regular exercise, massage, and, in selected cases, the careful administration of thyroid extract in small doses. An adipose woman is a poor object for labor, since the uterine contractions are apt to be deficient in power, whereas the pains are exaggerated. Moreover, adiposity of the mother is often accompanied by overgrowth of the child, difficulties of labor being thus increased for both.

Bladder Irritability.—**Pyelitis.**—Increased frequency of urination and pain during micturition are common symptoms in the early stages of pregnancy. They are frequently due to pressure of the enlarging uterus, and little beyond postural treatment (knee-chest and Sims' positions) can be done to relieve them. When they are first observed, a catheterized specimen of urine should be examined, and if no pus or blood is found, the postural treatment, in addition to use of a mild antiseptic (hexamethylenamin and sodium benzoate of each 0.3 gram (5 grains) t.i.d. may then constitute the treatment. If cystitis is present, the bladder must be gently irrigated and an antiseptic solution instilled into the viscus, and the postural treatment pushed until the condition clears up. This is done partly to relieve the patient of her symptoms, and partly to avoid the sequel of an untreated cystitis, namely, obstruction of the ureter, infection, and pyelitis.

VIII.

THE TREATMENT OF RHEUMATOID AFFECTIONS.

SAMUEL BRADBURY.

THE treatment of the rheumatoid affections, comprising arthritis deformans, variously known as chronic "rheumatism," infectious arthritis, rheumatoid arthritis and osteo-arthritis, and of myalgia, is decidedly unsatisfactory. There is probably no commonly seen chronic disease which so helplessly cripples the earning capacity of the average sufferer, and yet leaves him, in apparent good health, to die years later of some intercurrent disease. Yet the causative factors in these disorders are almost unknown.

A broad classification of all the common joint diseases would first divide them into the two great classes of metabolic and infectious disorders, with gout as a typical metabolic disorder, and acute rheumatic fever as an infectious process. Aside from these two easily differentiated types there is a great group of chronic joint diseases some of which, as gonorrhœal arthritis and tuberculous disease of joints, may be clearly classified as infectious arthritis. These specific infections of joints, with a few others which are less frequently encountered, comprise a small part of this great group. Of the remainder of the group, the majority of cases of chronic disease of the joints, very little of the etiology is known. The tendency of recent years has been to classify them all as probably due to chronic infections, either caused by the actual presence of bacteria in the joint or surrounding tissues, or by the action of toxins elaborated by a colony of microorganisms in some other part of the body. Such foci of infection are extremely common in all classes of individuals, and that in some persons they cause arthritis is explained by a lowered resistance to infection in that particular individual. Such a decrease in resistance may be brought about by exposure to cold and wet, by excessive work, either mental or physical, by poor living conditions or a badly balanced ration. Intercurrent infectious disease may act as a

cause, and in some cases it seems certain that undue static strains on joints, of the legs especially, may cause a localization of the infection. Recent work by Pemberton suggests that abnormal metabolism may play some part in chronic arthritis but whether it is true of all cases, or of an as yet undetermined group is not known. As nearly as can be estimated at present the disease is the same no matter what the type.

The chronic or recurring myalgias appear to have a grouping similar to that of the joints, including definite metabolic or gouty forms, and those caused by the same factors as are culpable in chronic arthritis. The treatment of the myalgias does not differ from that of the joints and both will be considered together.

There are cases of chronic arthritis, usually in young persons, in which early and adequate treatment, especially of some focus of infection, will lead rapidly to complete cure. In older patients who have had the disease for some time or who have a recurrence, but little may be done to restore them to useful lives. The process may be stopped or may stop of its own accord after ten or twelve years, leaving the patient crippled, perhaps bedridden, but free of pain and of symptoms of infection. An early recognition of the serious character of the disease is extremely important.

Treatment.—Foci of Infection.—The difficulty of clearly associating any definite focus of infection with an attack of arthritis should not deter the physician from a careful search for every possible collection of bacteria. Whether the pus pocket produces local symptoms or not is of little consequence. The only way in which one may estimate the effect of any pus pocket found upon the joint process is by its complete removal, and then noting whether or not there is any improvement. The complement fixation reaction has been tried, using mixed and autogenous antigens of various organisms, but it has been of no value.

Most of such collections of bacteria which may produce general symptoms are found in the head, the tonsils and teeth being the commonest locations. Examination of the tonsils should be thorough. It is not always possible to determine that infection exists by the presence of redness and œdema. The crypts and peritonsillar folds must be carefully examined. The teeth should be examined by the physician, by a competent dentist, and by x-ray. When all agree that there is infection present, treatment may be started. Pyorrhœa is easily found, and is of importance in the causation of arthritic symptoms. The presence of apical abscess is not so readily determined. The x-ray may disclose it; a tooth which has had the pulp and root canals evacuated and which has not been properly filled is always to be suspected. Its filling or cap should be removed and if there is pus at the root tip the tooth is best extracted. Dental treatment should be thorough and when it is finished the physician should be assured that all pus in connection with the teeth has been eliminated, but he should also see that the patient has sufficient dental equipment to properly masticate the food and should join with the dentist in condemning the general extraction of all teeth.

When pus pockets in the head have been found, the effect of their elimination should first be tried, and if no improvement result the search should be extended.

The nose and accessory sinuses should be carefully examined by an expert, with the assistance of x-rays. The frontal, sphenoid, and ethmoid sinuses, seem especially likely to be factors in arthritis. Operation upon these sinuses does not appear to be very satisfactory unless it be undertaken only to provide free drainage.

More unusual locations for foci of infection are the bronchi, the gall-bladder and ducts, and the urinary tract and pelvic organs in both male and female. The gastro-intestinal tract would provide many foci for collections of bacteria, but the difficulty of its careful examination, and the lack of knowledge of the normal bacterial inhabitants present difficulties in the elimination of foci in this location.

Hygiene.—One should remember that the probable reason foci of infection cause joint diseases is that the resistance of the individual has been much lowered by other factors and that many of these may be corrected. The living conditions, the diet, and the work of the patient should be carefully gone over and adjusted whenever they are at fault. An abundance of fresh air and sunshine, lessening of excessive physical or mental work, avoidance of dampness and cold, are very important in building up the health of the individual.

The diet as a rule should be a general one. Limitation of meat on account of the joint disease is wrong, and patients will usually improve when meat is allowed, provided there is no other reason, such as a chronic nephritis, for its limitation. Both fats and carbohydrates may usually be allowed in the normal proportion, but at times it may be advisable to reduce the carbohydrates. Pemberton has pointed this out, and further, that some patients will be better if the total calories are reduced. The patient who is emaciated should have the food increased.

Water should be taken in increased amounts as is usual in any infection.

Drugs.—There is no drug which has any influence upon the affected joints, any medication being symptomatic only.

Arsenic may be administered when there is anæmia. It may be given in combination with iron or alone. It is said that part of its beneficial action is due to the increased metabolism which follows its administration.

Iodine.—Iodine, usually prescribed as potassium iodide, is sometimes of benefit in the treatment of chronic arthritis. Its mode of action is not understood but it also is presumed to increase metabolism. Small doses, 0.2 to 0.6 gram (3 to 10 grains) are given three times daily after or with meals, well diluted in water or milk. It should be continued for months unless it disagrees with the patient.

Salicylates.—The only action the salicylates have in chronic arthritis is in the relief of pain. Either sodium salicylate or acetylsalicylic acid may be used. The sodium salicylate should be administered with an equal amount of bicarbonate of soda. The dosage should be smaller than that

used for acute rheumatic fever, and, if relief is not experienced in two or three days, it may be discontinued.

Cinchophen or *neocinchophen* has been prescribed for the same purpose as the salicylates—the relief of pain, and may be more effective in certain individuals.

Guaiacol carbonate, in doses of 0.3 gram (5 grains) three times daily, has been highly recommended for the relief of pain.

Vaccines.—Vaccines, both of the stock variety and autogenous preparations from various foci of infection, have been administered extensively in the treatment of chronic arthritis. Their use has in the main been disappointing, and, in the rare case when they have been of benefit, it is questionable whether improvement has not been due to a foreign protein reaction. When used for specific effect, the vaccine should be autogenous, it should be administered subcutaneously, and the interval between injections should be from four to ten days, depending upon the local and general reaction which is produced.

Foreign Protein.—The administration of some sterile foreign protein preparation has been tried out to a considerable extent in recent years. The mode of action of this procedure is not thoroughly understood, but its efficacy appears to bear some relation to the reaction (chill, fever, and sweat) produced, and the best results follow when an amount of the preparation just sufficient to produce a chill has been administered.

THE REACTION.—After injection of foreign protein there is first a leukopenia which occurs within a very few minutes, then a chill of variable intensity, which may appear in one to four hours, followed by fever of several hours duration which falls by crisis with a severe sweat. With the fever hyperleucocytosis appears but the number of leucocytes does not bear any relation to the degree of benefit produced. The leukopenia is considered due to a mobilization of the leucocytes of the circulating blood in the great viscera of the body, and not to their destruction; the leucocytosis to increased activity of the bone marrow. Besides the leucocytosis it has been found that the blood contains an increased amount of the specific and non-specific opsonins, lysins and agglutinins. In short it may be said that the reaction following the injection of foreign protein mobilizes all the immunizing factors of the body, though the blood cannot be shown to have an increased bactericidal power.

The patients who experience the most benefit are those in whom the arthritis has been of relatively short duration—two years or less, but cases of long standing may be much improved. The patient should always understand what is being done and what he may expect in the way of reaction. After the first injection and its accompanying reaction and improvement, patients are quite willing to have the injection repeated, and some will even beg to have it done.

THE MATERIAL.—A variety of materials foreign to the blood stream have been used, such as typhoid bacilli, proteose, normal horse serum, milk (administered subcutaneously only), and colloidal metals. Even hypotonic

and hypertonic salt solutions have been injected. It is said that the cautery, counterirritation, seton, and the country remedy, bee stings, all old fashioned in the treatment of chronic arthritis, act in the same way. For the present it seems best to advise the use of a typhoid vaccine. It may be easily procured, can be diluted to any strength, and, in this country at least, is the most widely used and the dosage is better understood.

The dosage advised varies from 10 to 15 million to 100 to 500 million organisms. The rule, to give an amount just sufficient to produce a chill, seems wise. It is therefore best to begin with the small amounts and to proceed gradually to an amount sufficient to produce the chill. The reaction should not as a rule be produced each day, as it is too severe for the patient. Every other day is often enough, and when there is much debility, or in cases of long standing, it is best to make the interval between injections one week. A few patients who have an arthritis of long standing or who are in poor general health, will not respond to the injection of foreign protein. In these cases it is presumed that the immunizing bodies have been so exhausted that they are incapable of response. Patients who experience no benefit after two injections should not be further subjected to the reaction.

TECHNIC OF INJECTION.—The patient should have an empty stomach before the injection is given. The solution used should be carefully kept sterile. A vein at the bend of the elbow is usually selected for the injection, though any superficial vein may be chosen. A sterile all-glass tuberculin syringe is the best for the purpose, with a needle of ordinary hypodermic calibre. The skin through which the needle is inserted should be sterilized with tincture of iodine.

CONTRAINDICATIONS.—The principal contraindications to the intravenous use of foreign protein are cardiac decompensation and acute endo- or pericarditis. Miller says that in 2000 injections given at the Cook County Hospital, Chicago, the only ill effect has been the onset of delirium tremens in old alcoholics.

The physician should understand that the reaction is not fully understood and that its limitations have not yet been fully worked out. In rare cases immediate harm has resulted, and it is not yet known whether or not late deleterious results may appear. It will not cure joints in which there has been inflammation for years, with much destruction of bone or surrounding tissues.

Local Treatment.—Various local measures have been employed in the treatment of arthritis. The best of these are the application of heat, massage, active and passive motion, and measures directed toward the prevention of deformity or of ankylosis in poor position. It is clear that none of these local measures are of use without the correction of such causes as are known, the removal of foci of infection, and the attempt to build up the general health and resistance of the patient.

Dry Heat.—The application of dry heat to chronically diseased joints has been in use for many years. Why it is beneficial is not understood, but has been explained upon two theories: 1, that it acts in somewhat the

same manner as the foreign protein reaction, a local mobilization of the immune bodies; and 2, that the benefit is brought about by the increase of metabolism.

The most convenient method of the application of dry heat is by an electric light cabinet, either of a size suitable for the entire body, or small ones which may be applied to such joints as are affected. Baking may be continued for 20 to 30 minutes. The patient should then receive an alcohol rub and the limb be kept warm.

Hydrotherapy has also been used for some time, but is not so convenient of application as dry heat, and does not seem to give such good results, possibly because the same degree of heat cannot be applied.

MASSAGE.—The chief value of massage is to keep the muscles in condition as they are necessarily disused owing to the painful joint involvement. The operator should always start easily and should never carry the work to the point where the patient is fatigued, nor should he traumatize an already inflamed joint. As a rule massage should follow baking and after both have been completed passive motion may be used, the degree depending upon the condition of the joint. Usually there is considerably more motion in the joint upon completion of baking and massage.

EXERCISE.—As acute inflammation subsides, passive exercise should be used, and, as the patient is able, active motion of the affected joint should start. It is of especial value to get these patients about out of doors.

PREVENTION OF DEFORMITY.—The advice of the orthopedist is often necessary in the prevention or correction of deformity. Early, during acute inflammation, if there is exceptional pain, a light splint may be applied but should be used for short periods only, as the danger of producing ankylosis is great. Later if contractures have ankylosed joints in impossible positions an effort may be made to straighten them by the use of extension and weights.

The orthopedist may assist materially in correcting various errors in posture. The proper correction of flat foot may so lessen strain upon an inflamed knee joint that its recovery occurs without any other measure.

In no other disease is the coöperation of the patient so much to be desired. Treatment is usually of tedious duration, and especially that part of it which is started after the more acute symptoms have subsided, and which should aim at the restoration of function of the diseased joint, requires that the patient should thoroughly understand exactly what is intended.

There are a certain number of cases of chronic arthritis, usually of some years duration, which have reached a stationary stage and are free of pain and of all symptoms of infection. Often the work required of these people, or the social niche in which they are found, does not demand of them more than they are capable of as then constituted. The joints are firmly ankylosed, the individual is comfortable, and unless it be carefully determined that the correction of some deformity will materially assist them, they are best let alone.

IX.

TREATMENT OF DISEASES OF METABOLISM.

SAMUEL BRADBURY.

I. GOUT.

FOR centuries past gout has been one of the unsolved problems of medicine. It is known that it occurs in some of those persons who are given to excesses in food and alcohol; that the liability to the disease is strongly hereditary; that it is more common among those who follow intellectual pursuits, though cases develop in manual workers under the influence of bad hygiene, poor food, and excessive alcohol; and that workers in lead seem especially disposed to the disease.

The best theory as to the pathology of gout, is that there is a disturbance of metabolism, probably of the nuclein portion of protein food. It is associated with an excessive production of uric acid, and a deposit of sodium biurate in the body tissues, particularly in those with a poor supply of blood.

Treatment is only preventive and symptomatic.

Prevention.—Those who inherit a marked tendency to gout should lead an outdoor life with plenty of physical work or exercise. They should abstain from all alcoholic beverages. Their food should be simply prepared and easily digestible, and its amount should be such that, while they are properly nourished, they will avoid any tendency to obesity. It is probably best to abstain from all the gland meats, such as sweetbread, liver, and kidneys, and to eat any meat but once daily. The digestive tract should be kept in good condition, and the bowels should move daily. Meals should be regular, and sufficient time should be allowed for their ingestion. Woolen underclothing is usually advised for wear throughout the year, and care should be taken to prevent chilling.

Treatment.—**The Acute Attack.**—The onset is usually sudden, the affection very painful, and early relief is demanded. An opiate, preferably morphine, may be necessary to relieve the pain.

LOCAL.—The affected part should be elevated and kept warm. Most patients prefer that the foot be wrapped in a thick layer of dry cotton wool, lightly bandaged on. This should be changed two or three times in the twenty-four hours as it becomes moist from perspiration. Some patients prefer an ointment, such as methyl salicylate or ichthyol, 20 per cent. in lard or lanolin. Others prefer warm liquid applications—50 per cent. alcohol, or lead water and laudanum. Occasionally when the pain is very severe, hot water fomentations or stupes, or a hot footbath, are grateful. All agree that cold applications are useless. The intelligent patient who has been through several “fits” of the gout will usually know what is best for him.

GENERAL.—A brisk purgative should be administered at the onset. Calomel in a single large dose, 0.3 gram (5 grains), or in divided doses, 0.13 gram (2 grains) in 8 doses of 0.015 ($\frac{1}{4}$ grain) each, given every half

hour, and followed in 5 to 8 hours by a Seidlitz powder or magnesium sulphate, is best.

For the relief of the affected joint *colchicum* is most efficacious. The best preparation is the active principle, colchicine, the dosage of which is 0.0006 to 0.001 gram. ($\frac{1}{100}$ to $\frac{1}{60}$ grain) every two hours for three or four doses, then every four hours until pain is relieved or symptoms of intolerance occur—nausea and vomiting, or looseness of the bowels. The individual reaction to the drug varies considerably, and patients should be warned to stop its ingestion at the first sign of toxicity or with relief of pain. The tincture of colchicum seeds may be used in doses of 1 to 2 cc. (15 to 30 minims) every four hours. It is often combined with potassium citrate in 1.0 gram (15 grain) doses, and best results follow its purgative action.

As the pain and swelling subside, *cinchophen* 0.5 gram (7 grains), or *neocinchophen* 0.7 gram (10 grains), may be given three or four times daily for periods of 5 to 7 days. Either drug increases the excretion of uric acid. Cinchophen (phenylcinchoninic acid) not infrequently causes pain over the stomach and gastric distress. It should then be combined with sodium bicarbonate. In large doses symptoms of salicylism are noted. Some persons have an idiosyncrasy to the drug and develop urticaria or other skin eruptions. Neocinchophen, in large doses according to Hanzlik and Scott, does not cause the gastric distress, nor the renal irritation, that may be caused by cinchophen, and it must be used in slightly larger doses to produce the same effect.

The *salicylates* are sometimes useful. When used early in an acute attack, they should be administered in large doses. Sodium salicylate 2 grams (30 grains) and an equal amount of sodium bicarbonate is taken with one-half glass of water, every two hours, until pain is relieved or symptoms of salicylism develop. Acetylsalicylic acid may be used in the same dosage, but it should not be combined with sodium bicarbonate. If the salicylates are used as the attack is subsiding, smaller doses, 0.3 to 0.6 gram (5 to 10 grains) are given after each meal.

In attacks in which the joint clears up slowly, *iodine* is beneficial. It may be given as potassium iodide, 0.3 to 0.6 gram (5 to 10 grains), well diluted in water or milk, with or after meals, or in a mixture combined with tincture of colchicum seed, 0.6 to 1.0 cc. (10 to 15 minims) after meals.

Numerous other remedies have been tried and usually found ineffective. Amongst them are the alkalies, the so-called uric acid solvents, and radium emanations. Old gouty patients will often have some special drug or method of procedure which, experience has taught them, will relieve their pain most quickly.

Surgery is not indicated in any acute attack, but it may be useful when there are ulcerating tophi, or when there is marked deformity.

THE DIET.—During acute attacks the nourishment should be limited to purin-free foods—milk, eggs, butter, white bread, rice, and fruit juices. In robust patients with slight fever, it is often best to allow milk only during the first day or two, and later, as the temperature subsides, bread or

toast, butter, eggs, and rice. The drinking of a large amount of water should be encouraged, and, if this may be accomplished by prescribing a spring water, one that is mildly alkaline, such as Vichy or Apollinaris, should be selected. As convalescence is established the diet is gradually increased, first allowing the purin-free foods, such as cheese, sago, macaroni, tapioca, and the cereals, and vegetables, and then after three months or more, a small portion of fish or chicken once daily.

TABLE OF PURINS IN FOOD.

Purin-free foods	Purin 0.6 to 1.0 grams
Milk	Lentils..... 0.637
Eggs	Beans..... 0.638
White bread	Plaice..... 0.795
Rice	Mutton..... 0.965
Sago	Rabbit..... 0.970
Tapioca	
Cheese	Purin 1.0 to 2.0 grams.
Butter	Halibut..... 1.02
Cabbage	Beef ribs..... 1.137
Lettuce	Veal loin..... 1.162
Cauliflower	Salmon..... 1.165
	Pork loin..... 1.212
Purin 0.01 to 0.09 grams.	Turkey..... 1.260
Potato.....0.02	Chicken..... 1.295
Onions.....0.09	Sirloin..... 1.305
	Ham..... 1.555
Purin 0.1 to 0.6 grams.	
Asparagus.....0.215	Purin over 2 grams.
Pea meal.....0.39	Beefsteak..... 2.066
Oatmeal.....0.53	Liver..... 2.752
Pork neck.....0.567	Sweetbread.....10.063
Tripe.....0.572	
Cod.....0.582	

The above table has been collected from several lists of analyses. It should be stated that, for some foods, the estimated amounts of purin differ widely. Amounts given are in grams per kilo.

MASSAGE.—As the swelling subsides most authorities encourage early use of the affected joint. Light massage, at first directed to the tissues about the joint, may be tried, and, if successful, the patient may be encouraged in the use of the limb. Local hot baths of the affected part are of value in ridding the joint of the remnants of inflammation.

The Interparoxysmal Period.—Certain general rules may be laid down, but it is important to realize that, in this disease, each patient is a therapeutic problem, and considerable effort must be expended in the endeavor to learn his individual peculiarities.

Habits in eating may be at fault. Food should be taken at regular times each day, and must not be bolted. It should be chewed carefully and not washed down with an excess of liquid. It is often advisable to order the meals taken without any beverage, thus making more thorough chewing probable and somewhat limiting the total amount of food.

DIET.—As a rule the most necessary regulation of the diet is a reduction of the total amount, and toward a greater simplicity. Usually too many

courses are served, and the various articles of food are too rich and too highly seasoned. It does not appear advisable to abstain from any one of the main groups of food stuffs for a long period—protein, fat and carbohydrate should all be represented.

PROTEIN.—None of the gland foods, such as sweetbreads, liver or kidneys, should be eaten at any time. They supply too much nuclein which forms amino purins. Other meats, beef, lamb, chicken, or fish, may be allowed in small portions once every other day or daily. Fish, if fresh and found to be readily digestible, may be eaten twice weekly. Shell-fish, lobster and crab may be taken occasionally, if they do not upset the digestion. Cheese is an excellent protein, and, as a rule, it is easily digested. Bouillons and meat stock soups should be prohibited, as they contain large amounts of meat extractives.

Carbohydrates.—The cereals (except oatmeal), sugar, potatoes, and flour preparations, are allowable provided there is no obesity. Asparagus, onions, spinach, and the legumes (peas, beans, and lentils), contain small amounts of purin, and are therefore restricted. Sorrel, tomatoes, and rhubarb may be taken unless there is oxaluria. Cabbage, cauliflower, lettuce, young lima beans, and string beans are allowed without restrictions. Fruit, either raw or stewed, should be eaten daily. Bananas and strawberries are usually prohibited, though some patients can take them without trouble. Vegetable soups and pureés, and cream soups, made without meat stock, are excellent.

Fat.—The easily digestible fats are allowed—butter, cream, or olive oil. A few small pieces of crisped bacon may be eaten. Ebstein advocated the use of fat as butter, and claimed that gouty patients lost weight when taking large amounts of it.

Condiments.—Excessive seasoning of food should be prohibited, as it interferes with digestion.

Coffee, tea, and chocolate provide methyl purins. They also exercise a considerable diuretic effect. They usually do no harm, and may be taken in moderation, provided they do not upset the digestion.

ALCOHOL.—Llewellyn proposes the following rules with regard to alcohol for the gouty:

- “1. The child of gouty parents should be a total abstainer.
2. In a young man, the first attack should mean abstinence thereafter.
3. The old man who has used alcohol moderately all his life, and who does not require it as a stimulant, should abstain.
4. Old men, habituated to its use or abuse, may continue to use it moderately.”

When alcohol seems advisable, small amounts, an ounce of whiskey, brandy or gin, taken well diluted with the meals, are best.

WATER.—In the absence of cardiac or kidney insufficiency, water should be freely drunk. A glass of hot water on rising, and another taken

when retiring, with 4 or 5 glasses during the day between meals, helps to prevent constipation, and will flush the kidneys. If the patient prefers, a carbonated water may be allowed.

CONSTIPATION.—Most gouty patients are constipated. This should be relieved by a daily laxative. A glass of hot water with the juice of half a lemon, taken on rising, may be effective in correcting constipation. Sodium phosphate is often efficacious in doses of 2 to 4 grams (30 to 60 grains) taken dissolved in a glass of water the first thing in the morning. The cause of the constipation should be determined if possible and corrected. It may lie in the diet, the habit of eating, or in one or another form of digestive trouble.

INDIGESTION.—Dyspepsia is very frequently seen in the gouty. There may be a hyperchlorhydria, or hyperacidity due to the formation of the organic acids. Often there is a chronic gastric catarrh with dilated stomach and hypoacidity. These may be treated as is advised in the section on disease of the stomach and intestines, paying especial attention to the dietary correction.

Many acute attacks are preceded by digestive difficulty, pricking and tingling in the tophi, twinges of pain in the toes, A brisk saline purge will frequently relieve these symptoms, and, it is claimed, will prevent an acute attack.

CLOTHING.—Woolen underclothing, lighter in summer, is usually advised. Care should be taken that the shoes fit well, and that there is no malformation in the feet which can be corrected.

EXERCISE.—Some regular daily exercise is of great value. It may be taken indoors or out, and care should be taken that it is not carried to the point of exhaustion. When the feet are badly deformed, patients should limit exercise to horseback riding or the gymnasium.

Mental worry and stress should be avoided whenever possible, and any condition tending toward a lowering of the general health level should be corrected.

The asthenic type of gout may be encountered. These individuals require increased feeding. The food should be simple, well prepared, and taken regularly three times daily. A more liberal amount of meat may be allowed, cereals, bread and potatoes are not restricted, and the patient should be encouraged to eat all the green vegetables and fruits.

Chronic Gout.—The patient who has been through numerous attacks and has several badly crippled joints, presents a difficult problem. Frequently the kidneys are functionally deficient and there is arteriosclerosis.

A complete and careful physical examination is of first importance in the treatment of chronic gout. Usually there is digestive difficulty or constipation which must be corrected. As a rule, a more liberal diet can be recommended, and it should meet the functional ability of the stomach and the intestines. If the kidneys are diseased, the treatment must be modified to conform to that usual in such disease.

Exercise, massage and hydrotherapy, are important adjuncts in the treatment. Care must be taken that the exercise advised is gauged to the

capacity of the circulatory apparatus. Massage should be general. With the nervous irritable patient, warm baths are best. For the plethoric, obese man, with sluggish circulation, stimulating hot or cold baths in sequence or alternation are advised.

A visit to one of the "cures" once or twice yearly is of value. Living in an equable climate will help in avoiding the subacute, painful attacks to which these patients are subject.

The subacute attacks of swelling and pain, to which chronic gouty patients are subject, are best treated with small doses of colchicine 0.0006 gram. ($\frac{1}{100}$ grain) three times daily for 5 to 6 days. When pain and swelling are obstinate, the combination of tincture of colchicum and potassium iodide is of value. Cinchophen and neocinchophen may also be tried.

Complications.—Diseases of the heart, kidneys, or blood vessels, are treated as is usual in these conditions. Glycosuria is usually mild and easily controlled by reduction of the starchy food.

Many patients are overweight, and, not only feel better, but do not have as much difficulty with deformed feet, if they can slowly lose 15 to 20 pounds.

TOPHI.—Easily accessible tophi, if painful, or causing disability, may be removed by strictly aseptic surgery. The incision should be made through the healthy skin at the base of the mass, and the wound will heal by first intention. It is best, too, to remove a large fluctuating tophus which seems about to perforate the skin, rather than allow it to discharge.

II. DIABETES MELLITUS.

With inability, at the onset, to properly dispose of carbohydrates, diabetes mellitus usually progresses until the metabolism of fats and of proteins is also deficient. No remedy has yet been found which will increase the tolerance for carbohydrates, so the treatment of the disease is directed at sparing this disordered function by a careful adjustment of the food intake to the capabilities of each patient. Proof that the capacity, or tolerance, of the patient has not been exceeded, is furnished by urine which is sugar- and acid-free, and by blood in which the sugar does not exceed the normal level.

Prevention.—Members of families in which diabetes has been frequent, and certain obese persons, may be proven to have an intolerance for amounts of sugar (glucose) which are easily handled, without glycosuria, by normal persons. Such individuals should not eat sugar, and they should restrict the starchy food ingested, largely replacing it with vegetables of low carbohydrate content. They should take some form of daily exercise, and if possible, should live out of doors and avoid severe mental stress.

Treatment.¹—Aside from the dietary regulations which must be carefully prescribed for each individual, there are several general rules which every diabetic should observe.

¹Pancreatic extracts have been used unsuccessfully in the treatment of diabetes for some years. Recently, however, Banting and his co-workers of Toronto, have produced an extract of pancreas which, injected subcutaneously, appears to directly aid in the metabolism of carbohydrate in the diabetic dog and in human diabetes. The originators have wisely placed the use of the substance in the hands of a number of men experts in the care of diabetics, and for that reason it is not yet on the market. The dosage and mode of action are not fully understood and administration, without rigid control of blood and urine, cannot now be advised. Insulin, or "Iletin," promises exceedingly well.

HABITS.—They should dress warmly, and, whenever possible, live in a warm climate. Prolonged exposure to cold or chilling should be avoided. It is best to avoid worry and great responsibility. Most diabetics are better when their occupation is one requiring physical exertion but no mental stress.

EXERCISE.—Exercise must be carefully adapted to the physical capacity of the individual. As a rule, mild cases, children and young adults, increase their carbohydrate tolerance, and improve rapidly, with daily exercise which is nearly to the limit of their physical endurance. For the severe types, emaciated or anæmic, old persons, and those with damaged heart and kidneys, exercise must be carefully prescribed in kind and amount. Patients should recover from the fatigue of exercise with an hour's rest. In very severe cases, or in those who have the handicap of badly damaged blood-vessels or decompensated heart, general massage may be indicated, either alone or supplementary to limited exercise.

WATER.—Water should be taken regularly and in amounts of one and one-half to three liters (quarts) daily. If preferred, it may be carbonated.

SKIN.—The skin must be kept scrupulously clean by a daily bath. A tepid or warm bath is best, as few diabetics stand cold well. The most insignificant skin infection must be carefully cared for, not only because it may result in a severe infection, but because it lowers the tolerance for carbohydrate.

The mouth very easily becomes foul and the teeth carious. The latter should be cleaned with a soft brush after each meal and a mild antiseptic mouth wash should be used two or three times daily.

The stomach and intestines are not now so likely to be upset, as when the diabetic was forced to eat large amounts of fat. Any indigestion or other abnormality should be corrected.

The bowels should move daily. Mineral oil may be tried. An enema is often sufficient. Cascara, aloin, or the aloin, belladonna and strychnine pill may be used. A proper diet with green vegetables is the best corrective.

INFECTIONS.—Above all, the diabetic must avoid infections of every kind. If a mild infection, such as a cold, be contracted, exceptional care must be taken of it, and glycosuria and acidosis watched for. It is often best to reduce the diet, especially the fats, in the presence of infection even if no sugar appears. Chronic foci of infection appear to have a deleterious influence in keeping the carbohydrate tolerance low. In every case they should be searched for and eliminated whenever possible.

The Diet.—The crucial part of the treatment of the diabetic is such control of the food intake that he will, on the one hand, remain sugar- and acid-free, and, on the other hand, maintain all the strength possible.

During the past decade F. M. Allen has demonstrated that: 1.—Excessive or improperly balanced fat feeding is the cause of acidosis, and that elimination of fat from the diet is its best cure; 2.—The easiest method of ridding patients of glycosuria, acidosis, and hyperglycæmia, is by fasting; 3.—That patients will then develop a tolerance for carbohydrate, and that

they remain in better condition after fasting, if kept sugar- and acid-free even if weight be lost.

Joslin says there are four principles to be kept in mind in the treatment of diabetes—the prevention of acidosis, attainment of a substantial carbohydrate balance, education of the patient and thereby a simplification of the treatment, and the prevention of inanition.

PROCEDURE.—There are three plans of procedure by which the diabetic may be made sugar- and acid-free. All depend upon a low total food intake and, in the intractable and severe cases, an ultimate fast.

1. The abruptly instituted fast, continuing until the patient is sugar-free, was the plan originally suggested by Allen. He still institutes the fast at once, but, as a rule, does not starve the patient more than four days without a break.

2. The fast, following a short preparatory treatment to eliminate any danger of acidosis, as suggested by Joslin.

3. A diet in which protein is maintained at about one gram per kilogram (2.2 pounds) of body weight. Fat is first eliminated for 2 days, with the same idea as in the second plan. Carbohydrate is then rapidly reduced until but ten grams, or less, are taken. If, after several days of this protein diet, the urine fails to become sugar-free, the protein is cut down rapidly, and, ultimately, with continued glycosuria, a fast is given.

For the physician who is not familiar with all grades of diabetes, and who has not a carefully trained nursing and assistant staff, one of the latter plans is wiser. Joslin's plan is more widely known and is given in detail. There is some evidence that the preliminary elimination of fat not only guards against acidosis, but even appears to clear up sugar more quickly.

PREPARATION FOR FASTING (Joslin).—"In severe, long standing, complicated, obese, and elderly cases, as well as in cases with acidosis, or in any case if desired, without otherwise changing habits or diet, omit fat, after two days omit protein, and then halve the carbohydrate daily until the patient is taking only ten grams; then fast. In other cases begin fasting at once."

The chief advantage of the preparatory absence of fat, and the gradual reduction of the other components of the diet, is the prevention of acidosis, or its elimination if already present. Some cases become sugar- and acid-free as the diet is lowered, rendering starvation unnecessary.

THE FAST.—The fast is of four days duration unless the urine is earlier sugar-free. During the reduction of the diet, and during the fast, fluid ingestion must be maintained. Hot tea, coffee, thin clear meat broths, or bouillon, are allowed. Water should be given in amounts of 1.5 to 2 liters (quarts). Salt and pepper are allowed as flavoring for the broths, the salt appearing to be necessary to prevent the loss of too much body fluid. Patients are not strictly confined to bed. They may rest in a chair or take short walks.

INTERMITTENT FASTING.—If glycosuria persists through four days of fasting, the patient is given one gram of protein, or 0.5 gram of carbohy-

drate, per kilogram (2.2 pounds) body weight, for two days. He is then fasted three days, then again given the same kind and amount of food for two days, and fasted one or two days. If there is still sugar in the urine the patient is fed four days, given a one day fast, and then the periods of feeding are increased one day at a time, with fasts of one day, until, in each week, the patient is eating six days and fasting one day. The food given is protein, one gram per kilogram of body weight. The object of the interrupted fast is to prevent the loss of body protein, and weight. Joslin says: "I have seen no uncomplicated case fail to get sugar-free by this method." Whenever sugar persists so obstinately, a careful search should be made for any chronic or acute infection. A small boil, causing very little local discomfort, may so lower tolerance for food in severe diabetics, that traces of sugar persist for days.

CARBOHYDRATE AND PROTEIN TOLERANCE.—After the twenty-four hour urine is sugar-free the patient can nearly always take some carbohydrate without glycosuria. He is therefore given 5 to 10 grams, in the form of vegetable of 5 per cent. carbohydrate content, and, if no sugar appears in the urine, this amount is increased by 10 grams the second day. As the object of gradually increasing the food intake is to learn upon what diet the patient may subsist, on the third day he is given, with the carbohydrate, twenty grams of protein, as fish, egg, or lean meat. Thereafter, unless sugar reappears, the diet is increased daily by 5 to 10 grams of carbohydrate, and fifteen grams of protein, until the patient takes one gram of protein for each kilogram of weight, usually 60 to 80 grams. The gradual increase of carbohydrate is continued until the patient takes 50 to 100 grams or more, depending upon the apparent severity of the case. As the carbohydrate intake mounts, 10 per cent. vegetables may be partly substituted for those of less starch content, and later, even those of the 15 per cent. group. Even if carbohydrate is well taken, Joslin advises against increasing it to an amount in excess of three grams per kilogram of body weight, about 180 to 210 grams.

For a man of 70 kilograms (154 pounds) such a diet—protein 70 grams, carbohydrate 210 grams, if that much can be taken—would furnish only 1120 calories, or 16 calories per kilogram. A normal person, at rest in bed, can subsist on food supplying 20 calories per kilogram. The diabetic is said to be able to live on less food than the normal individual, but, as a rule, 16 calories per kilogram is not sufficient to prevent inanition in the diabetic; always provided that this amount, or less, keeps him sugar-free, and with normal blood sugar. Fat is therefore added to provide the necessary calories.

FAT TOLERANCE.—The day after the patient receives his complete protein ration, fat is added to the diet. If the patient is obese, or has had severe acidosis, 5 to 10 grams are given, and increased daily by the same amount; with other patients fat may be added in 25 gram amounts "until the patient ceases to lose weight, or receives in the total diet thirty calories per kilogram of body weight." With regard to fat and diabetics, Joslin's aphorism

should be quoted, "With an excess of fat diabetes begins, and from an excess of fat diabetics die." Should fat not be well taken, its addition to the diet may be postponed and more protein added, up to 100 grains or more.

REAPPEARANCE OF SUGAR.—The reappearance of sugar, at any time, means a fast of twenty-four hours or until sugar-free. The urine is examined daily, preferably by the patient, and the fast instituted at once. It is well for the patient to understand this clearly, and also, that each time sugar reappears, it is more difficult to again build up the tolerance for starch; he is then less liable to break his diet. When the urine is sugar-free, the diet is again built up, but more slowly than the first time, taking months before it is finally adjusted.

WEEKLY FAST DAYS.—Several of the older clinicians recognized the advantage of an occasional day upon which food was reduced to a minimum, and this practice is still found to be advantageous in severe cases. Joslin advises a regular fast day in each week. If the carbohydrate tolerance is above 20 grams, the caloric intake is halved; if below 20 grams, only clear meat broths, or tea and coffee, are to be taken. In children and old persons, Joslin allows a small amount of 5 per cent. vegetable in addition to the broths.

THE PROTEIN DIET.—The diet in which protein is retained, may be outlined as follows. Fat is first eliminated for two or three days, while protein and carbohydrate are given in amounts of 60 to 100 grams each. Then the carbohydrate is reduced rapidly over three or four days, until but 10 grams is taken, and the diet is continued at this level for several days. If sugar persists, the protein is reduced, or starvation instituted, allowing only broths, tea, coffee and water. In building up the diet protein is given first, 60 to 100 grams daily; then carbohydrate, at the rate of 5 to 10 grams increased daily to 100 grams, if taken without glycosuria. Fat is then given and increased slowly, 5 to 10 grams in severe cases, more rapidly in mild cases, until enough is taken to supply sufficient calories.

Complications.—**ACIDOSIS AND COMA.**—The prevention of this hazard to the life of the diabetic is far easier than its cure, and has been sufficiently commented upon. Allen says, "The majority of patients in deep coma still die, and also the earlier stages are often not checked, but progress to the fatal end." When mental sluggishness or nervous excitement, vomiting or diarrhoea, or hyperpnoea occur, no time can be lost.

The bowels must be moved by repeated enemas or purgation. Allen advises purgation; Joslin prefers the enemas. A diarrhoea should not be produced if none exist. If present a mild saline may be given, such as a Seidlitz powder.

FLUIDS.—The patient must have enough fluid to cause the excretion of two liters (quarts) of urine a day. The fluid is preferably given by mouth, but if not enough can be taken orally, salt solution should be given by bowel, and in necessity, by the veins, it being then so slowly administered that a weakened heart muscle is not overtaxed by the sudden increase of circulating fluid.

ALKALI.—Quite recently alkali was given first place in the treatment of severe diabetic acidosis, and still has many advocates. Now, Joslin is directly opposed to its use in any way, and believes more harm than good is done. Allen is opposed to its use by vein, but thinks it occasionally useful when given by mouth or rectum.

If used *sodium bicarbonate* is the best drug. Large amounts, 50 to 100 grams (2 to 3 ounces), are given daily, 60 to 75 grams in the first twelve hours, the remainder thereafter. Mouth administration is best, as the drug is then taken more rapidly. Two heaping teaspoonfuls, about 10 grams, dissolved in each glass of water, will, with eight glasses taken in the day, give the patient 80 grams of the drug. If the stomach does not retain such doses, a 3 per cent. solution may be given by rectal drip, and the same strength solution may be used intravenously.

Solutions of sodium bicarbonate cannot be sterilized for intravenous use in the usual way, as the necessary heat changes the bicarbonate into sodium carbonate, a caustic alkali. To prepare a sterile solution of sodium bicarbonate, one of three methods may be chosen. 1. Joslin measures, with sterile implements, the necessary amount of the chemical from a freshly opened package, and dissolves this amount in a previously sterilized and cooled physiological salt solution. He has found the resulting solution to be sterile. 2. The solution, made in cool water, is filtered through a porcelain filter. 3. The solution, sterilized in the usual manner, is cooled, and carbon dioxide gas is then bubbled through until the alkaline reaction to phenolphthalein disappears. All solutions are used at room temperature.

Joslin's rules for the treatment of threatened coma are summarized. The patient is put to bed, and is kept warm with hot water bottles and extra blankets. The bowels are moved by repeated enemas. If the patient is vomiting, the stomach is washed out. Every six hours 1000 cc. of hot liquid (water, tea, coffee, or thin broth) is given by mouth if possible. With inability to take this amount, a rectal drip of tap water is started, and at the end of the six hours, any fluid, less than the 1000 cc., not taken by either of these methods, is given by vein as physiological saline. If the patient is fasting, or accustomed to fasts, no food is given. If not, carbohydrate, 1 gram per kilogram of body weight, is given every 24 hours as orange juice or oatmeal gruel. The heart is sustained with digitalis or caffeine. Both Allen and Joslin say whiskey is worthless.

BOILS AND CARBUNCLES.—After control of the glycosuria, cleanliness of the skin is most important. The utmost care must be taken that pus does not spread to other parts of the body. The underclothing should be changed daily, and, if in bed, the patient should have a daily change of sheets. Bowen advises a complete soap and water bath twice daily, drying the skin without rubbing, and then bathing it with a saturated solution of boric acid in water. Vaccines may be useful. With carbuncles, efficient surgery must be instituted. The röntgen ray has been highly advocated for carbuncles in ordinary cases.

PRURITIS.—The irritation of the genitalia appears to be due to the sugar-containing urine, and clears up rapidly when sugar has disappeared. For general pruritis sodium salicylate, internally, has been highly recommended by Von Noorden.

GANGRENE.—The first requisite is treatment of the diabetes as outlined above. Locally, the part should be at absolute rest and a sterile dressing applied. Heat, preferably applied continuously by the small electric light cabinet which is used for the treatment of burns, or by hot foot baths every four hours, is exceedingly useful, and seems to relieve the pain. Bandages and dressings must be so loose that they do not interfere with the circulation. If operation be necessary, the patient should be prepared as is described under surgical procedures.

NEPHRITIS.—Both diseases must be treated by suitable changes in the diet. Less protein is usually given, and all salt avoided.

NEURITIS.—When the blood sugar is normal the pain of neuritis may disappear. In obstinate cases, the usual measures for the treatment of any neuritis are carried out. Rest of the affected part is necessary.

PREGNANCY.—It is now possible to carry pregnancy through to term by careful attention to diet. The patient should be kept sugar-free, and fats especially restricted. Cæsarean section, under gas and oxygen anaesthesia, is said to be safer than a prolonged labor.

AMBYOPIA.—Visual difficulty, due to cataract, should be operated upon. The amblyopia caused by retinitis and hemorrhage will decrease slowly and to some extent on a proper diet.

TUBERCULOSIS.—The patient with diabetes and tuberculosis improves more rapidly when the diabetes is adequately treated. Rest in bed is imperative, as in uncomplicated tuberculosis. An effort is made to free the urine of sugar on a high protein, low carbohydrate, no fat diet. Fasting is usually not well borne.

Surgery.—**THE ANÆSTHETIC.**—Gas and oxygen are the safest for any operation upon the diabetic. Chloroform is dangerous on account of its effect upon the liver. Ether is less toxic, but should be avoided whenever possible. In suitable cases spinal anaesthesia may be used. Local infiltration anaesthesia should be used very carefully, if at all, because of the trauma to the tissues.

THE PATIENT.—When time allows, the patient should be made sugar- and acetone-free. During the day preceding, and up to as near the time of operation as possible, the patient should receive a large amount of fluid. After operation the rectal drip is started at once, and water should be given by mouth when practicable. On the day after operation the patient should fast, taking only fluids. Then, if the urine is sugar-free, food may be allowed, first as carbohydrate and protein, and, as recovery is assured, fats may be added.

Asepsis, rapidity in operating, and the avoidance of trauma, have all assisted in making surgery safer for the diabetic.

If the operation be an emergency one, all the fluid possible must be gotten into the patient in the few hours before operation, and the rectal drip should be started as soon as the patient is back in bed.

DIABETIC DIETARY FOR.....

ONE OUNCE, 30 GRAMS, CONTAINS APPROXIMATELY.

Protein Gm.	Fat Gm.	Calories.	Oz. Gm. Directions.
8	5	75	1. No carbohydrate
6	0	25	Meat, poultry, cooked, lean.
6	6	75	Fish, cooked, lean.
5	15	150	Egg, one.
8	11	130	Bacon, cooked.
0	25	225	Cheese.
0	30	270	Butter.
0	0	0	Olive oil.
0	0	0	Coffee, tea, cocoa shells.
0	0	0	Broths.
0	0	100	Whiskey.
20	0	80	Special flour made from casein.
0.5	0	5	2. Carbohydrate 1 gram.
			Vegetable cooked; celery, okra, vegetable marrow, tomato, leeks, chard, asparagus, brussels sprouts, spinach, cauliflower, cabbage, beet greens, dandelion greens, string beans, egg plant, sauerkraut.
0.5	0	5	Vegetable raw; lettuce, endive, cabbage tomato, celery, water-cress, cucumber, radishes.
0	0	5	Grapefruit, lemons.
6	1	35	3. Carbohydrate 1 gram.
1	6	60	Cottage cheese.
2	0.5	15	Cream 20 per cent.
9	15	180	Oysters, clams.
0.5	4	40	Butter-nuts, pignolias.
			Olives.
1	1	20	4. Carbohydrate 1.5 grams.
1	0	10	Milk.
			Milk skimmed, butter-milk.
0.5	0	10	5. Carbohydrate 2 grams.
			Vegetable cooked, beets, carrots, squash onions, turnips.
0.5	0	10	Vegetable raw; onions, turnips.
0	0	10	Orange, peach, pineapple, watermelon, muskmelon, strawberries, blackberries, cranberries.
4	20	200	Brazil nuts, hickory nuts, pecans, filberts.
1	0	20	6. Carbohydrate 4 grams.
0	0	15	Vegetable cooked; green peas, parsnips.
			Apples, pears, cherries, apricots, huckleberries, raspberries.
5	18	200	Walnuts, almonds, pistachios.
1	0.5	25	Oatmeal porridge (1-5).

DIABETIC DIETARY.—*Continued.*

ONE OUNCE, 30 GRAMS, CONTAINS APPROXIMATELY.

Protein Gm.	Fat Gm.	Calories.	Oz. Gm. Directions.
1	0	25	7. Carbohydrate 5 grams. Vegetable cooked; green lima beans, green corn.
0	0	25	Plums, apples baked, prunes boiled.
1	0	25	Wheat cereal porridge, macaroni boiled.
1	0	30	8. Carbohydrate 6 grams. Potato, baked or boiled.
1	0	30	Rice, boiled.
0.5	0	30	Banana.
3	0	90	9. Carbohydrate 18 grams. Bread.
6	0.5	90	Beans, dried.
3	3	125	10. Carbohydrate 20 grams. Crackers.
5	2	120	Oatmeal, dryweight.

From "A Diabetic Dietary" by E. E. Cornwall, Journal of the American Medical Association 1920-75-1642.

The original form employed is printed on a sheet 8½ by 12¼.

COMMERCIAL DIABETIC FOODS.

From "Report of the Connecticut Agricultural Experiment Station, on Food Products and Drugs, Part II. Diabetic Foods, being Bulletin 220." Foods selected from Table IV, p. 276.

Brand of Food.	Manufacturer.	Protein. * Per cent.	N-Free Extract.		Fat. Per cent.	Calories per 100 Grams.
			Starch. Per cent.	Other N-Free Ext. by diff. Per cent.		
Alpha No. 1 Best Diabetic Wafer Cascin.....	H. F. Co.	48.38*	none	4.89	33.52	515
Snowflake Diabetic Cascin Flour.....	H. F. Co.	79.19*	none	3.18	1.15	340
Diabetic Cascin Flour (self raising).....	H. F. Co.	72.25*	none	5.73	0.79	319
Diabetic Flour Self Rising....	L. B. Inc.	68.31*	none	9.72	0.95	321
Cascin Bread.....	Loeb's.	40.84*	none	3.35	10.84	274
Cascin Muffins.....	Loeb's	45.74*	none	7.03	11.37	313
Diaprotein.....	N-T	77.75*	none	2.72	1.46	335
Soy Bean Gruel Flour.....	The C. Co.	46.13*	0.90	21.86	18.63	443
Alpha No. 2 Best Diabetic Wafer.....	H. F. Co.	70.50*	1.13	6.25	4.02	348
Protosoy Soy Flour.....	H. F. Co.	39.38*	1.86	25.10	18.58	433
Akoll Biscuit.....	H. & P.	56.13*	1.80	5.80	25.52	485
Baumgarten Process Allison Flour.....	S. O. M.	50.00*	1.13	21.61	10.04	381
Soy Bean Flour "A".....	S. B. F. P. Co.	41.81*	0.34	24.07	19.44	440
Soy Bean Flour "B".....	S. B. F. P. Co.	44.00*	0.76	25.98	14.20	411
Hepco Dodgers.....	W. H. P. Co.	42.44*	1.01	21.56	16.73	411
Hepco Flour.....	W. H. P. Co.	44.00*	0.90	21.41	19.14	438
Hepco Grits.....	W. H. P. Co.	40.25*	0.87	23.91	16.39	408
Gluten Food "A".....	H. B.	76.95	2.56	9.84	0.44	361
Proto Puffs No. 1.....	H. F. Co.	69.08	3.26	10.74	4.67	371
Pure Washed Gluten Flour...	H. F. Co.	74.90	3.77	10.04	1.97	373
Pure Gluten Biscuit.....	The K. F. Co....	78.38	2.87	6.53	1.50	365
Pure Gluten Meal.....	The K. F. Co....	79.12	2.56	8.74	0.74	368
Hoyt's Special Gluten Flour 80 Per Cent. Protein.....	The P. G. F. Co.	77.18	2.81	10.63	1.19	373

COMMERCIAL DIABETIC FOODS.—Continued.

Brand of Food.	Manufacturer.	Protein. * Per cent.	N-Free Extract		Fat. Per cent.	Calories per 100 grams.
			Starch Per cent.	Other N-Free Ext. by diff. Per cent.		
Peanut Butter Beechnut Brand	B. P. Co.	30.38*	5.04	7.55	49.91	621
Peanut Butter Acme Brand	J. W. B.	31.25*	5.29	8.53	48.27	615
Curdolac Flour	S. R. Spa.	56.63*	5.09	17.89	2.36	335
Diabetic Chocolate	Loeb's.	14.69*	7.26	15.52	51.74	716
Gluten Food "B"	H. B.	73.99	5.23	10.14	0.51	362
Gluten Food "C"	H. B.	72.90	6.39	9.80	0.40	360
Protosoy Diabetic Wafer	H. F. Co.	46.50*	10.58	14.23	15.51	421
Protosac Bread No. 1	H. F. Co.	35.97	20.53	7.39	4.00	292
Manana Gluten Breakfast Food	H. F. Co.	44.80	21.99	12.47	8.69	396
Gluten Cracker Dust	H. F. Co.	44.52	23.18	11.83	8.76	398
Gluten Breakfast Cereal	Loeb's	29.18	25.51	17.78	19.38	464
Glutosac Bread	H. F. Co.	27.70	20.78	10.33	3.70	293
Genuine Gluten Bread	Loeb's	28.39	28.56	6.86	2.10	273
Gluten Flour	M. M.	47.99	28.63	10.23	1.65	365
Gluten Flour 40 Per Cent.	K. F. Co.	47.20	30.66	10.17	0.98	261
Genuine Gluten Flour	P-L. Co.	41.38	36.31	9.79	1.35	362
Diet Ease Gluten Flour	P. & W.	39.56	36.20	11.78	2.32	371
Genuine Gluten Flour 40 %	F. & R.	40.47	37.01	9.42	1.47	361

* The protein content of foods so starred was calculated from estimated nitrogen content by multiplication by the factor 6.25; for foods not so starred protein content was calculated by multiplying the nitrogen content by the factor 5.70 as is explained in the quotation from Bulletin 220 below.

H. B.	Herman Barker, Somerville, Mass.
The C. Co.	The Cero Company, Tappan, N. Y.
F. & R.	The Farwell and Rhines Co., Watertown, N. Y.
H. F. Co.	The Health Food Company, New York City.
H. & P.	Huntley and Palmer, London.
K. F. Co.	The Kellogg Food Company, Battle Creek, Michigan.
L. B. Inc.	Lister Brothers, Inc., New York City.
Loeb's.	Loeb's Diabetic Food Bakery, New York City.
M. M.	Mayflower Mills, Fort Wayne, Indiana.
N-T.	Norton-Truax, Chicago, Illinois.
P-L. Co.	Peiser-Livingston Company, Chicago, Illinois.
P. & W.	Potter and Wrightington, Boston, Mass.
P. G. F. Co.	The Pure Gluten Food Company, Columbus, Ohio.
S. O. M.	Schulenburg Oil Mill, Schulenburg, Texas.
S. R. Spa.	Still Rock Spa, Waukesha, Wisconsin.
S. B. F. P. Co.	Soy Bean Food Products Company, San Francisco, Cal.
W. H. P. Co.	Waukesha Health Products Company, Waukesha, Wisconsin.
J. W. B.	J. W. Beardsley's Sons, Newark, N. J.
B. P. Co.	Beechnut Packing Company, Canajoharie, N. Y.

NOTE.—"INTERPRETATION OF ANALYSES.—Protein.—The proper basis for comparison of the nitrogenous material in diabetic or other foods is the nitrogen content. But proximate analyses require a statement of protein content and this is ordinarily obtained from the nitrogen figure by use of the conventional factor 6.25, which is based on the assumption that protein contains 16 per cent. of nitrogen.

"The Federal definition and standard for 'gluten' products is based upon the observation that wheat proteins contain about 17.5 per cent. of nitrogen which requires a factor of 5.70 to express the protein in wheat products.

"This being the case, we have used the factor 5.70 to calculate the protein in such materials as are known, or declared, to be gluten products. In all other cases the conventional factor 6.25 has been used. It is recognized that 6.38 is a more correct factor for milk proteins, but a variation of 0.13 in the factor is almost within the limit of analyt-

ical error and certainly within the limits of variation in factory control of these products from time to time, so that no attempt has been made to apply this more accurate factor to casein preparations.

"Nitrogen-free Extract.—The interpretation of this term has been made clear in previous reports but it may be briefly restated. In proximate analyses nitrogen-free extract is an expression used to cover the difference between 100 per cent. and the sum of the percentage amounts of moisture, ash, protein, fibre and ether extract (crude fat). In general it so closely approximates the total carbohydrates, *i. e.*, starch, sugars, etc., that the term is used synonymously with carbohydrate. Obviously, the percentage of this constituent group varies according to the protein factor used. In other words, it will be higher if 5.70 is used to calculate protein than if 6.25 is employed.

"In addition to starch, nitrogen-free extract includes carbohydrates which we may call available, accepting the term 'available' to mean those materials which directly reduce Fehling's solution or do so after treatment with acid and therefore presumably yield glucose in metabolism, and carbohydrates which are non-available or less available in human metabolism. The first class includes soluble starch, dextrine, maltose, glucose, sucrose, invert sugar, raffinose, lactose and some other less common sugars. The second group includes substances, collectively termed hemicelluloses, which occur as vegetable cell-wall constituents, and soluble vegetable gums and mucilages sometimes called saccharo-colloids. Although these compounds yield sugars of the hexose and pentose types, it is doubtful if they play any considerable part in metabolism other than that of the ruminant animals.

"The interpretation of nitrogen-free extract, represented by a figure obtained by difference, as synonymous with carbohydrate, does injustice to certain diabetic food products, notably casein preparations, which are free or practically free from carbohydrates.

"In our tables of analyses starch is indicated as a part of the nitrogen-free extract; the remainder represents the difference from 100 per cent. as stated." (Bulletin 220, Connecticut Agricultural Experiment Station.)

III. DIABETES INSIPIDUS.

The patient with diabetes insipidus seeks relief from the excessive thirst, and from the necessity of emptying the bladder at frequent intervals both day and night.

The history and physical examination may disclose possible causal factors, such as a recent infectious disease, an old syphilis, or signs of organic disease of the base of the brain, or of the hypophysis. A case has been reported recently which was apparently due to chronic infection of the tonsils, as it cleared up after their removal.

Patients with a history of syphilis, or with a positive Wassermann reaction should receive intensive antisyphilitic treatment.

Symptomatic Treatment.—Fluids should be allowed as desired by the patient, even to 30 and 40 liters (quarts) of water daily. No attempt should be made to restrict them, nor should any attempt be made to restrict the food, except in a few cases which are obese. The gradual reduction of salt and of protein is worth a trial, as some cases have been distinctly benefited by this procedure. Lumbar puncture and withdrawal of fluid until there is no excess of pressure may produce marked benefit.

PITUITARY EXTRACT.—The only medicinal remedy, which has proven to be of any value, is a preparation of the posterior lobe of the pituitary gland, *hypophysis sicca* U.S.P., or liquor hypophysis U.S.P. The Pharmacopeia calls for the standardization of this drug so that one cc. (15 minims) will have the same effect on the isolated virgin uterus of the

guinea-pig as a dose of one cc. (15 minims) of a 1 to 1000 solution of beta-iminazolyethylamine hydrochloride. A few cases have been reported as improved on the administration of a preparation of hypophysis by mouth. The dose of the dry preparation is 0.1 to 0.2 gram (1 to 3 grains), three times daily. For most patients the subcutaneous injection of liquor hypophysis 0.5 to 1.0 cc. (8 to 15 minims) is necessary. The commercial preparations, solutions of the principles of the posterior pituitary lobe, are standardized according to the rules of the Pharmacopœia, and are distributed in glass ampoules of 0.5 and 1.0 cc. capacity. They are sterile and far more convenient for administration.

The action of the injected drug lasts about twelve hours. It is therefore best given once daily several hours before bedtime so that an undisturbed rest may be obtained. The administration of the drug must be continued as long as symptoms continue.

IV. OBESITY.

Obesity, as usually encountered, is caused by more food than is necessary for the current physical activities of the individual, though a few persons, whose food intake is quite small, may suffer from overweight. In many excessively obese persons the outstanding transgression in the diet is an inordinate consumption of food of high carbohydrate content, such as sugar, cake, sweets, and bread. In others the total food is in excess. The ingestion of an excess of fat alone is unusual. For normal adult weights, an intake of 36 to 38 calories per kilogram (2.2 pounds) per day is sufficient for average physical activity.

Treatment.—The treatment of obesity is, primarily, such a rearrangement of the diet that nitrogen equilibrium is maintained by a sufficient protein ration, and carbohydrates and fats are so reduced that the body fat is gradually used in producing the required daily energy. As a secondary factor in reduction, exercise is important. Fluid intake must be regulated in a few cases, and, rarely, drugs are necessary.

Upon undertaking the care of a case of obesity, a careful appraisal of the physical condition of the patient must be made, and it must be determined that reduction is advisable. The condition of heart, blood vessels and kidneys must be examined into. The height and weight of the patient, and the average normal weight for persons of the same height and age, are recorded. It is best to estimate carefully the patient's usual daily intake of protein, fat, and carbohydrate, and the amount of fluids.

Reduction should be gradual, about one pound a week, except in extreme cases, when a loss of 10 to 15 pounds may be allowed in the first month. A diet supplying plenty of bulk, usually furnished by vegetables of low carbohydrate content, is more satisfying to the patient, and he is then less prone to go beyond the prescribed ration, or to eat between meals.

The Diet.—In mild obesity, where a reduction of not more than thirty pounds is desired, the proscription of sugar, sweets, cake, cream, and olive

WEIGHT TABLE (FEMALE).

Showing average weight for each height and age. Based on "Nylic Graphic Table."

Age.	57 ins.	58 ins.	59 ins.	60 ins.	61 ins.	62 ins.	63 ins.	64 ins.	65 ins.	66 ins.	67 ins.	68 ins.	69 ins.	70 ins.	71 ins.	72 ins.	73 ins.
20	100	103	106	109	113	116	120	123	127	130	134	138	142	147	152	156	161
21	101	104	107	110	114	117	120	124	127	131	135	139	143	148	152	157	162
22	101	105	107	110	114	118	121	124	128	132	136	140	144	149	153	158	162
23	102	105	108	111	115	118	122	125	128	132	137	140	145	149	154	158	163
24	102	106	108	111	115	119	122	126	129	133	137	141	145	150	155	159	164
25	103	106	109	112	116	119	123	126	130	134	138	142	146	151	155	160	165
26	103	107	110	113	117	120	124	127	131	134	139	143	147	151	156	161	166
27	104	107	110	113	117	121	124	128	131	135	139	144	148	152	157	162	166
28	104	108	111	114	118	121	125	128	132	136	140	144	149	153	158	162	167
29	105	108	111	114	118	122	126	129	133	136	141	145	149	154	158	163	168
30	105	109	112	115	119	123	126	129	133	137	141	146	150	154	159	164	169
31	106	109	112	116	119	123	127	130	134	138	142	146	151	155	160	165	170
32	106	110	113	116	120	124	127	131	135	138	143	147	151	156	161	166	170
33	107	110	113	117	120	124	128	131	135	139	143	148	152	156	162	166	171
34	107	110	114	117	121	125	128	132	136	140	144	149	153	157	162	167	172
35	108	111	115	118	122	125	129	133	137	140	145	150	154	158	163	168	173
36	108	112	115	119	122	126	130	133	137	141	146	150	154	159	164	169	174
37	109	112	116	119	123	126	130	134	138	142	146	151	155	160	165	170	175
38	109	113	116	120	123	127	131	135	139	142	147	152	156	161	166	170	175
39	110	113	117	120	124	128	131	135	139	143	148	153	157	161	166	171	176
40	110	114	117	121	124	128	132	135	140	144	148	153	157	162	167	172	177
41	111	114	118	121	125	129	132	136	140	145	149	154	158	163	168	173	178
42	111	115	118	122	125	129	133	137	141	145	150	155	159	163	169	173	179
43	112	115	119	122	126	130	134	138	142	146	150	156	159	164	169	174	179
44	112	116	119	123	127	130	134	138	142	147	151	156	160	165	170	175	180
45	113	116	120	123	127	131	135	139	143	148	152	157	162	166	171	176	182
46	113	117	120	124	128	131	136	139	143	149	153	158	162	167	172	177	182
47	114	117	121	124	128	132	136	140	144	149	154	159	163	168	173	178	183
48	114	118	121	125	129	133	137	141	144	149	154	159	164	168	174	179	184
49	115	118	122	125	129	133	138	141	145	150	154	159	164	169	174	179	185
50	115	119	122	126	130	134	138	142	146	150	155	160	164	169	174	179	185
51	116	119	123	126	130	134	139	143	147	151	156	161	165	170	175	180	186
52	116	120	123	127	131	135	139	143	147	152	156	161	166	170	176	181	186
53	117	120	124	127	131	135	140	144	148	153	157	162	166	171	177	182	187
54	117	120	124	128	132	136	140	144	148	153	158	162	167	172	177	182	188
55	118	121	125	128	132	136	140	145	149	154	158	163	168	173	178	183	188

oil is usually sufficient. If this fail, desserts, fat meats, cereals, and part of the bread allowance may be forbidden.

NORMAL DIET.—In more severe cases the entire diet should be rearranged. First, the food intake should be adjusted to the usual amount and proportions necessary for persons of normal weight. That is, a diet should be prescribed which will approximately conform to the following table:—

	DIET PER KILOGRAM.		DIET PER POUND.	
	Grams.	Cals.	Grams.	Cals.
Protein.....	1.00	supply	4.0	0.45 supply 1.82
Fat.....	1.23	supply	11.17	or 0.56 supply 5.03
Carbohydrate....	5.55	supply	22.2	2.52 supply 10.08
Daily calories			37.37	16.93

For a man of average proportions weighing 70 kilograms (154 pounds), a diet so proportioned would contain about 70 grams of protein, 85 grams of fat, and 390 grams of carbohydrate, and would supply about 2600 calories. In formulating such a diet the basic diet (below), supplying about 1500 calories, may be used. Experience has shown that, on the normal food intake, the desired reduction in weight frequently occurs.

WEIGHT TABLE (MALE).

Showing average weight for each height and age. Based on "Nylie Graphic Tables."
Correct to 1 pound.

Age.	57 ins.	58 ins.	59 ins.	60 ins.	61 ins.	62 ins.	63 ins.	64 ins.	65 ins.	66 ins.	67 ins.	68 ins.	69 ins.	70 ins.	71 ins.	72 ins.	73 ins.
20	104	108	111	114	117	121	125	128	132	136	140	144	149	153	158	163	167
21	105	108	111	115	118	122	125	129	133	137	141	145	150	154	159	164	168
22	106	109	112	116	119	123	126	130	134	138	142	146	151	155	160	165	169
23	106	109	113	116	119	123	127	130	135	138	143	147	152	156	161	166	170
24	107	110	114	117	120	124	128	131	136	139	144	148	153	157	162	167	171
25	108	111	114	118	121	125	128	132	136	140	144	149	154	158	163	168	172
26	108	111	115	118	122	126	129	133	137	141	145	150	154	159	164	169	173
27	109	112	116	119	122	127	130	134	138	142	146	150	155	160	165	170	174
28	109	112	116	120	123	127	130	134	138	142	147	151	156	161	166	170	175
29	110	113	117	120	124	127	131	135	139	143	148	152	157	162	167	171	176
30	110	114	117	121	124	128	132	136	140	144	148	152	157	162	167	172	177
31	111	114	118	121	125	129	133	137	141	145	149	153	158	163	168	173	178
32	111	115	118	122	125	129	133	137	141	145	150	154	159	164	169	173	179
33	112	115	119	122	126	130	133	138	142	146	150	155	159	164	170	174	179
34	112	116	119	123	126	130	134	138	142	147	151	155	160	165	170	175	180
35	112	116	120	123	127	131	134	139	143	147	152	156	161	166	171	175	181
36	113	117	120	124	127	131	135	139	143	148	152	156	161	166	172	176	181
37	113	117	120	124	128	131	135	140	144	148	153	157	162	167	172	177	182
38	113	117	121	124	128	132	136	140	144	149	153	158	162	167	173	177	183
39	114	118	121	125	129	132	136	141	145	149	154	158	163	168	173	178	183
40	114	118	122	125	129	133	136	141	145	149	154	158	163	168	173	178	184
41	114	118	122	125	129	133	137	141	146	150	154	159	164	168	174	179	184
42	115	118	122	126	130	133	137	142	146	150	155	159	164	169	174	179	185
43	115	119	123	126	130	134	138	142	146	151	155	160	165	170	175	180	185
44	115	119	123	126	130	134	138	143	147	151	155	160	165	170	175	180	186
45	116	119	123	126	131	134	138	143	147	151	156	161	165	170	176	181	186
46	116	119	123	127	131	135	139	143	147	152	156	161	166	170	176	181	186
47	116	120	124	127	131	135	139	144	148	152	157	161	166	171	176	181	187
48	116	120	124	127	131	135	139	144	148	152	157	161	166	171	177	182	187
49	117	120	124	127	131	135	139	144	148	153	157	162	167	171	177	182	187
50	117	120	124	127	132	136	140	144	148	153	157	162	167	172	177	182	188
51	117	120	124	128	132	136	140	145	149	153	158	162	167	172	178	182	188
52	117	121	125	128	132	136	140	145	149	153	158	162	167	172	178	183	188
53	117	121	125	128	132	136	140	145	149	154	158	163	168	172	178	183	188
54	118	121	125	128	132	136	140	145	149	154	158	163	168	173	178	183	188
55	118	121	125	128	132	136	140	145	149	154	158	163	168	173	178	183	188

REDUCING THE DIET.—If, after careful trial of the normal diet for 1 or 2 weeks, no weight has been lost, the food is reduced about 200 calories each week, until a weight loss of one pound per week is maintained. The first articles forbidden are the sweets—sugar and desserts, then part of the bread, and all the vegetables of high carbohydrate content, and later, if necessary, butter and fats. As the diet is reduced, it is best to increase the protein intake by the addition of 1 or 2 eggs, and of meat, so that with an intake of 1500 calories the protein should be about 100 grams. This prevents the loss of body protein which may be used for energy in place of the absent carbohydrates.

Fluid Restriction.—Usually, as the body weight declines in response to undernourishment, the fluids of the wasting excess tissues are excreted, and the urinary output thus increased. It has long been asserted empirically, that in certain cases of obesity, in which there is no circulatory or kidney disturbance which may be held to account, fluid restriction is necessary to lessen weight. Lately Grafe has pointed out that some obese patients do not eliminate the water of burned tissues, and that, in these cases, fluid intake must be restricted to produce a satisfactory loss of weight.

TABLE FOR BASIC DIET.

Food.	Wt. Gms.	Household Measure.	Cals.	P.	F.	C.
Orange.....	100	1 medium	50	.8	.2	11.6
Coffee with cream.....	30	2 tablespoonfuls	60	1.0	6.0	1.0
Cereal cooked.....	120	3 tablespoonfuls	105	3.0	1.0	21.0
Milk.....	105	One-half glass	72	3.3	4.0	5.0
Bread or toast.....	30	1 average slice	70	2.9		16.0
Lunch						
Milk.....	210	1 glass	140	6.5	8.3	10.5
Banana.....	100	1 medium	100	1.3	.6	22.0
Bread.....	60	2 average slices	140	5.8		32.0
Butter.....	10	pat 1 x 1 x ¼ inches	75		8.1	
Dinner						
Steak, sirloin.....	100	Average serving	250	18.9	18.5	
Corn.....	100	3 tablespoonfuls	100	2.8	1.2	19.0
Lima beans.....	100	3 tablespoonfuls	125	7.1	.7	22.0
Potato.....	100	1 medium	96	2.5	.1	20.9
Bread.....	60	2 average slices	140	5.8		32.0
		Totals	1523	61.7	48.7	213.0
If to the above diet is added						
Bread.....	90	3 average slices	210	8.7		48.0
Butter.....	40	4 pats	300		32.4	
Sugar.....	35	5 lumps	140			35.0
Potato.....	100	1 medium	96	2.5	.1	20.9
Rice pudding.....		3 tablespoonfuls	240	5.2	2.0	50.0
Peach or pear.....	100	1 medium	65	.6	.5	14.1
The daily intake will amount to			2574	78.7	83.7	381.0

As was noted in the text, when the intake is reduced to that represented in upper table, protein should be added, either as eggs or meat.

By the use of the tables of foods, page 258, changes may be made in the above diet to suit individual needs.

In this event, when the diet has been restricted to an amount one-fourth or one-third below that of the normal intake, and there has been no adequate loss of weight, the fluids must be cut down. The amount usually prescribed is 1 to 1.5 liters (2 to 3 pints) a day. In some of the cases of obesity a "milk day" may be interposed once or twice weekly, upon which day the patient takes but four glasses of milk. This procedure combines restriction of nourishment (to about 600 calories), and restriction of fluids to about 900 cc. (30 ounces).

SALT INTAKE.—In all cases of obesity, it is best to restrict the salt to that which is used in the kitchen in the preparation of the food.

Exercise.—The lack of exercise is not infrequently an important contributing cause of obesity. In the cure, its use is of importance second only to diet restriction. In order that exercise may be intelligently prescribed, a careful estimate of cardiac and circulatory function is necessary. Violent exercise should not be undertaken at once. The muscles,

including the heart, must be trained for increased demands. In extremely fat persons, walking on level ground is the best exercise at first. Later as the muscles grow accustomed, hill climbing may be undertaken. Golf in older persons, tennis in the young, are excellent as the patient becomes hardened. During periods of bad weather the more strenuous exercises may be taken in a gymnasium, the "setting up" exercises of the Army, the medicine ball, and boxing.

SLEEP.—The patient, so often somnolent, should not be allowed more than eight hours sleep. He should take a walk of a half hour's duration after each meal, instead of a nap.

BATHS.—The professional gymnasium and health institute proprietors always sweat their obese patrons, usually in an electric light cabinet. The treatment is probably especially indicated in the cases with water retention.

Drugs.—**CATHARTICS.**—As a rule saline cathartics are indicated; they aid in the extraction of water. The dosage should aim at producing one or two slightly liquid stools daily.

IRON.—Some obese women and girls are anæmic, and improve more rapidly on the administration of iron. Reduced iron, in the dose of 0.06 to 0.1 gram (1 to 2 grains), in capsules, or the freshly made pill of ferrous carbonate (Blaud's pill), in doses of 0.1 to 0.3 grams (2 to 5 grains), may be given three times daily after meals. As a rule, in anæmic patients, the diet should not be restricted below that for normal weights until an effort has been made to bring the hæmoglobin to a normal level.

ENDOCRINE THERAPY.—In a very few patients deficiency of the thyroid, pituitary, or ovarian secretion, appears to be the direct cause of obesity. These cases are considered under the section on disorders of the endocrines, but here it may be stated that thyroid should never be given unless the patient is under close observation. Neither should the administration of this drug be considered a routine measure for the treatment of obesity.

The complications of cardiac and blood-vessel disease are treated as if they were primary diseases. The reduction of overweight in any cardiac deficiency or in hypertension is very desirable.

V. AMYLOID DISEASE.

When amyloid disease is discovered or suspected there is already considerable irreparable damage in the affected organ.

Chronic tuberculosis of the lungs or of bone, and syphilis, localized in bone, or, especially in the rectum, are the two most frequent causes. Rickets has been reported as an unusual cause, and any chronic collection of pus due to organisms other than those mentioned is, rarely, the apparent underlying factor.

Treatment.—Any suppurative bony process should be operated upon and the necrotic bone excised. Chronic syphilis requires intensive treatment in any event. In the cases due to pulmonary tuberculosis but little more can be done than the usual treatment prescribed for consumption.

The symptoms, referable to disability of the organ which is chiefly involved, are treated as is any other functional deficiency of these organs. Such treatment is found described in the respective parts of this work.

The commonest seat of trouble is in the kidneys, causing symptoms very like those of chronic interstitial nephritis. Disease of the intestines is associated with diarrhœa. There may be widespread amyloid degeneration of the liver without symptoms.

FOODS AND THEIR CHEMICAL COMPOSITION.

(Selected from "The Chemical Composition of American Food Materials" (Corrected April 14, 1906), by W. O. Atwater, Ph. D. and A. P. Bryant, M. S., Bulletin, No. 28 (Revised Edition), U. S. Department of Agriculture.)

	Protein Per cent.	Fat Per cent.	COH Per cent.	Cals. per pound.
BEEF, cooked				
Cut not given, boiled as purchased.....	26.2	34.9		2805
Scraps, as purchased; average.....	21.4	51.7		2580
Roast, as purchased; average.....	22.3	28.6		1620
Round steak, fat removed, as purchased; average.	27.6	7.7		840
Sirloin steak, baked as purchased.....	23.9	10.2		875
Loin steak, broiled, edible portion; average.	23.5	20.4		1300
Tongue, whole, as purchased; average.....	19.5	23.2		1340
LAMB, cooked				
Chops, broiled, edible portion; average.....	21.7	29.9		1665
Leg roast.....	19.7	12.7		900
MUTTON, leg roast, edible portion; average	25.0	22.6		1420
PORK, fresh loin chops, medium fat, edible portion; average.....	16.6	30.1		1580
HAM, smoked, boiled as purchased; average.....	20.2	22.4		1320
Ham, boneless, raw, edible portion; average	14.9	28.5		1480
BACON, smoked, edible portion; average.....	10.5	64.8		2930
CHICKEN broilers, edible portion, fresh; average..	21.5	2.5		505
Fowls, edible portion, fresh; average.....	19.3	16.3		1045
Capon, edible portion cooked; average.....	27.0	11.5		985
Chicken, fricaseed, edible portion; average.....	17.6	11.5	2.4	855
FISH, fresh				
Bass, black, whole, edible portion; average.....	20.6	1.7		455
Bluefish, entrails removed, edible portion; average	19.4	1.2		410
Cod steaks, edible portion; average.....	18.7	.5		370
Flounder, whole, edible portion; average.....	14.2	.6		290
Haddock, entrails removed, edible portion; average.....	17.2	.3		335
Halibut steaks, edible portion; average.....	18.6	5.2		565
Mackerel, whole, edible portion; average.....	18.7	7.1		645
Salmon, landlocked, whole, spent, edible portion; average.....	17.8	3.3		470
Shad, whole, edible portion; average.....	18.8	9.5		750
Shad roe as purchased; average.....	20.9	3.8	2.6	600
Trout, brook, whole, edible portion; average	19.2	2.1		445
Fish, preserved and canned				
Sardines, edible portion; average.....	23.0	19.7		1260
Salmon, edible portion; average.....	21.8	12.1		915
Tunny canned in oil.....	23.8	20.0		1300

TABLE OF FOODS.—*Continued.*

	Protein Per cent.	Fat Per cent.	COH Per cent.	Cals. per pound.
<i>Shell-fish, etc., fresh.</i>				
Clams removed from shell as purchased.....	10.6	1.1	5.2	340
Crabs, hard shell, whole, edible portion.....	16.6	2.0	1.2	415
Lobster, whole, edible portion; average.....	16.4	1.8	.4	390
Oysters in shell, edible portion; average.....	6.2	1.2	3.7	235
<i>EGGS, hens' boiled, edible portion; average.....</i>				
Eggs, hens' boiled whites, edible portion; average.	12.3	.2		250
Eggs, hens' boiled yolks, edible portion; average.	15.7	33.3		1705
<i>DAIRY PRODUCTS, etc.</i>				
Butter as purchased; average.....	1.0	85.0		3605
Buttermilk, as purchased; average.....	3.0	.5	4.8	165
Cheese, American pale, as purchased; average..	28.8	35.9	.3	2055
Cheese, full cream, as purchased; average.....	25.9	33.7	2.4	1950
Cheese, cottage, as purchased; average.....	20.9	1.0	4.3	510
Cheese, pineapple, as purchased; average.....	29.9	38.9	2.6	2245
Milk, condensed sweetened, as purchased; aver- age.....	8.8	8.3	54.1	1520
Milk, condensed unsweetened, "evaporated cream," average.....	9.6	9.3	11.2	780
Milk, skimmed, as purchased; average.....	3.4	.3	5.1	170
Milk, whole, as purchased; average.....	3.3	4.0	5.0	325
<i>Miscellaneous</i>				
Gelatine, as purchased; average.....	91.4	.1		1705
Oleomargarine, as purchased; average.....	1.2	83.0		3525
<i>VEGETABLE FOOD, FLOURS, MEALS, etc.</i>				
Hominy, cooked, parched; average.....	11.5	8.4	72.3	1915
Rollod oats; average.....	16.7	7.3	66.2	1850
Rice; average.....	8.0	.3	79.0	1630
Wheat flour; average.....	7.9	1.4	76.4	1625
Wheat flour, entire wheat; average.....	13.8	1.9	71.9	1675
Farina; average.....	11.0	1.4	76.3	1685
Shredded wheat; average.....	10.5	1.4	77.9	1700
Macaroni; average.....	13.4	.9	74.1	1665
<i>BREAD, CRACKERS, PASTRY, etc.</i>				
Bread, corn, as purchased; average.....	7.9	4.7	46.3	1205
Graham bread, as purchased; average.....	8.9	1.8	52.1	1210
Biscuit, soda; average.....	9.3	13.7	52.6	1730
Rolls, all analyses, as purchased; average.....	8.9	4.1	56.7	1395
White bread from bakers' flour; average.....	10.6	1.2	48.3	1145
Graham crackers, as purchased; average.....	10.0	9.4	73.8	1955
Saltines; average.....	10.6	12.7	68.5	2005
Soda crackers; average.....	9.8	9.1	73.1	1925
Cup cake, as purchased; average.....	5.9	9.0	68.5	1765
Frosted cake, as purchased; average.....	5.9	9.0	64.8	1695
Gingerbread, as purchased; average.....	5.8	9.0	63.5	1670
Sponge cake, as purchased; average.....	6.3	10.7	65.9	1795
Cookies, as purchased; average.....	7.0	10.2	73.2	1920
Doughnuts, as purchased; average.....	6.7	21.0	53.1	2000
Pie, apple, as purchased; average.....	3.1	9.8	42.8	1270
Pie, mince, as purchased; average.....	5.8	12.3	38.1	1335
Pudding, rice custard, as purchased; average....	4.0	4.6	31.4	825
Pudding, tapioca; average.....	3.3	3.2	28.2	720
<i>SUGARS, STARCHES, etc.</i>				
Candy, as purchased.....			96.0	1785
Honey, as purchased; average.....	.4		81.2	1520

TABLE OF FOODS.—*Continued.*

	Protein Per cent.	Fat Per cent.	COH Per cent.	Cals. per pound.
Molasses, cane, as purchased; average.	2.4		69.3	1290
Corn starch, as purchased.			90.0	1675
Sugar, granulated, as purchased.			100.0	1860
Syrup, maple, as purchased.			71.4	1330
VEGETABLES				
Asparagus, fresh, as purchased; average.	1.8	.2	3.3	105
Beans, butter, green, edible portion.	9.4	.6	29.1	740
Beans, lima, fresh, edible portion.	7.1	.7	22.0	507
Beans, string, fresh, edible portion; average.	2.3	.3	7.4	195
Beets, fresh, edible portion.	1.6	.1	9.7	215
Cabbage, edible portion; average.	1.6	.3	5.6	145
Carrots, fresh, edible portion; average.	1.1	.4	9.3	210
Cauliflower as purchased; average.	1.8	.5	4.7	140
Celery edible portion; average.	1.1	.1	3.3	85
Corn, green, edible portion; average.	3.1	1.1	19.7	470
Egg plant, edible portion; average.	1.2	.3	5.1	130
Lettuce, edible portion; average.	1.2	.3	2.9	90
Onions, fresh, edible portion; average.	1.6	.3	9.9	225
Peas, green, edible portion; average.	7.0	.5	16.9	465
Potatoes, fresh, edible portion; average.	2.2	.1	18.4	385
Potato chips as purchased; average.	6.8	39.8	46.7	2675
Potatoes, sweet, raw, edible portion; average.	1.8	.7	27.4	570
Rhubarb, edible portion; average. ....	.6	.7	3.6	105
Spinach, fresh, as purchased; average.	2.1	.3	3.2	110
Squash, edible portion; average.	1.4	.5	9.0	215
Tomatoes, fresh, as purchased; average. ....	.9	.4	3.9	105
<i>Vegetables, canned</i>				
Asparagus, as purchased; average.	1.5	.1	2.8	85
Beans, baked, as purchased; average.	6.9	2.5	19.6	600
Beans, string, as purchased; average.	1.1	.1	3.8	95
Beans, lima, as purchased.	4.0	.3	14.6	360
Corn, green, as purchased; average.	2.8	1.2	19.0	455
Peas, green, as purchased; average.	3.6	.2	9.8	255
Tomatoes, as purchased; average.	1.2	.2	4.0	105
PICKLES, CONDIMENTS, etc.				
Horseradish, evaporated, as purchased, average..	11.0	.8	77.7	1685
Olives, green, edible portion; average.	1.1	27.6	11.6	1400
Olives, ripe, edible portion, average.	1.7	25.9	4.3	1205
Pickles, mixed, as purchased.	1.1	.4	4.0	110
FRUITS, BERRIES, etc., fresh				
Apples, edible portion; average. ....	.4	.5	14.2	290
Bananas, yellow, edible portion; average.	1.3	.6	22.0	460
Blackberries, as purchased; average.	1.3	1.0	10.9	270
Cherries, edible portion; average.	1.0	.8	16.7	365
Grapes, edible portion; average.	1.3	1.6	19.2	450
Huckleberries, edible portion; average. ....	.6	.6	16.6	345
Lemons, edible portion; average.	1.0	.7	8.5	205
Lemon, juice; average.			9.8	180
Muskmelon, edible portion; average. ....	.6	9.3	.6	185
Oranges, edible portions; average. ....	.8	.2	11.6	240
Peaches, edible portion; average. ....	.7	.1	9.4	190
Pears, edible portion; average. ....	.6	.5	14.1	295
Pineapple, edible portion; average. ....	.4	.3	9.7	200
Raspberries, red, as purchased; average.	1.0		12.6	255

TABLE OF FOODS.—*Continued.*

	Protein Per cent.	Fat Per cent.	COH Per cent.	Cals. per pound.
Strawberries, edible portion; average.....	1.0	.6	7.4	180
Watermelons, edible portion; average.....	.4	.2	6.7	140
<i>Fruits, etc., Dried</i>				
Apricots, as purchased; average.....	4.7	1.0	62.5	1290
Dates, edible portion; average.....	2.1	2.8	78.4	1615
Figs, as purchased; average.....	4.3	.3	74.2	1475
Prunes, edible portion; average.....	2.1		73.3	1400
Raisins, edible portion; average.....	2.6	3.3	76.1	1605
<i>Fruits, etc., Canned, Jellies, Preserves, etc.</i>				
Apple sauce, as purchased.....	.2	.8	37.2	730
Marmalade, (orange peel), as purchased.....	.6	.1	84.5	1585
Peaches, as purchased; average.....	.7	.1	10.8	220
Pears, as purchased; average.....	.3	.3	18.0	355
Pineapples, as purchased.....	.4	.7	36.4	715
<i>NUTS</i>				
Almonds, edible portion; average.....	21.0	54.9	17.3	3030
Brazil nuts, edible portion.....	17.0	66.8	7.0	3265
Chestnuts, fresh, edible portion; average.....	6.2	5.4	42.1	1125
Cocoonut without milk as purchased.....	3.6	31.7	17.5	1730
Cocoonut, prepared as purchased; average.....	6.3	57.4	31.5	3125
Peanuts, edible portion; average.....	25.8	38.6	24.4	2560
Peanut butter, as purchased.....	29.3	46.5	17.1	2825
Pecans, polished, edible portion.....	11.0	71.2	13.3	3455
Walnuts, California, edible portion; average....	18.4	64.4	13.0	3300
<i>Miscellaneous</i>				
Chocolate, as purchased; average.....	12.9	48.7	30.3	2860
Cocoa, as purchased; average.....	21.6	28.9	37.7	2320
Yeast, compressed, as purchased.....	11.7	.4	21.0	625
<i>Unclassified Food Materials, Animal and Vegetable</i>				
Meat stew, as purchased; average.....	4.6	4.3	5.5	370
<i>SOUPS, CANNED</i>				
Asparagus, cream of, as purchased; average....	2.5	3.2	5.5	285
Celery, cream of, as purchased.....	2.1	2.8	5.0	250
Corn, cream of, as purchased.....	2.5	1.9	7.8	270
Pea soup, as purchased; average.....	3.6	.7	7.6	235
Pea, cream of green, as purchased.....	2.6	2.7	5.7	270
Tomato soup, as purchased, average.....	1.8	1.1	5.6	185
<i>Miscellaneous</i>				
Sandwich, egg, as purchased.....	9.6	12.7	34.5	1355
Sandwich, chicken, as purchased.....	12.3	5.4	32.1	1055

X.

THE TREATMENT OF DISEASES DUE TO THE DEFICIENCY
OR ABSENCE OF CERTAIN NORMAL FOOD ELEMENTS.
THE FOOD-DEFICIENCY DISEASES.

J. C. WILSON.

THIS group of diseases has for a decade comprised beri-beri, scurvy, pellagra and rickets. Beri-beri, long recognized as a multiple neuritis, was many years prevalent among the sailors of the Japanese navy until the diet was improved (1884). From that date the disease diminished and in the course of a short period almost wholly disappeared. Beri-beri was attributed to the rice which entered largely into the ration of the navy. The investigation of Eijkman (1887) led to the discovery that fowls and pigeons restricted to a diet of polished rice rapidly developed symptoms of polyneuritis, and that these symptoms disappeared in a short time when rice polishings were added to the food. His inference that the outer coat of the rice kernel contains some substance essential to the normal nutrition of birds has been fully confirmed. Funk (1910) undertook the problem of the isolation of the curative substance in rice polishings, extending his researches to yeast and other foodstuffs in order to ascertain the distribution of the antineuritic substance among ordinary articles of diet. Minute quantities of certain preparations which he obtained when administered to birds suffering from neuritis, caused by an exclusive diet of polished rice, yielded curative results, which amounted to positive evidence that the disease was due to the absence of some chemical substance in the food. This undetermined substance, active in extremely minute doses, he designated vitamin. Subsequently he included under this name several hypothetical substances which he regarded as specific in preventing the occurrence of scurvy, pellagra and rickets. McCollum and Davis (1912) experimentally proved that there is something associated with butter fat and egg yolk fat not previously recognized, but essential to the young rats used in the research as a constituent of their food. They further established the fact that a second previously unsuspected substance, physiologically active, soluble in water and alcohol, and never associated with fats or oils, constitutes a second dietary essential. This substance is present in minute amounts in almost all natural foods. To these two substances which are as yet not identified, but are known by their effects, and can be administered separately in the diet, McCollum and Kennedy (1916) applied the terms fat-soluble A, and water-soluble B. These terms are indefinite because the composition of the substances to which they are respectively applied are as yet unknown; they are sufficiently descriptive because they indicate very clearly a distinguishing peculiarity of each. McCollum holds the view that all other terms as accessory food substances, growth substances,

growth determinants, food hormones, and in particular "vitamines" are misnomers. He and his co-workers hold that "there is but one unidentified chemical substance in butter fat and egg fat which is indispensable to nutrition, and that the alcoholic extracts employed for the addition of the other unidentified dietary essential likewise contain but a single indispensable substance." A young laboratory animal fed upon a diet of purified proteins, carbohydrates and fat, with the addition of suitable inorganic salts, will live no longer than if given no food at all. It must receive in addition the two substances fat-soluble *A* and water-soluble *B*. When the animal is fed such a diet, with the addition of the fat-soluble *A* but without the addition of water-soluble *B*, it fails to grow and in a little time develops polyneuritis with paralysis; when to the diet is added water-soluble *B* but not fat-soluble *A*, the young animal fails in growth but does not become paralyzed. In the course of a few weeks the tissues around the eyes become swollen and the eyes themselves intensely inflamed, and unless the lacking dietary essential is added to the diet, blindness ensues. This condition has been regarded as a form of xerophthalmos. It can be produced in the animal only by the withdrawal from the food of fat-soluble *A* and can be cured in no other way than by the addition to the food of the essential factor, the absence of which caused it. It is said to have been observed as a disease of human beings caused by a faulty diet. Subsequent elaborate research in many laboratories make it clear that neither the "*A*" nor the "*B*" was the vitamine that possessed the power to prevent or cure scurvy, although the one-time wide prevalence of that disease and the empirically successful food conditions by which it has been controlled pointed to it as a typical member of the group of deficiency diseases. The existence of a third member of the vitamine group gradually became evident as one working hypothesis after another eliminated errors and uncertainties; and at last the discovery of the Antiscorbutic Vitamine "*C*" was announced (Drummond, 1920). This unidentified chemical substance is water soluble like "*B*" but differs from it in chemical properties and behavior. That further studies will reveal corresponding substances "*D*" and "*E*" active in the etiology of rickets and pellagra is the confident expectation of workers in this field of investigation. It is thus seen that there are two views as to the subject of deficiency diseases: first, that of McCollum, which looks upon beri-beri and xerophthalmos as the only members of the group in a scientific sense; and second, that of Funk, which would include also scurvy, pellagra and rickets. The first has the support of rigid laboratory research but would restrict the meaning of the word "deficiency" to very narrow limits. The second view rests largely upon the facts which have been proved in regard to beri-beri and scurvy and amounts to the extension of a working hypothesis to include the other two of the above associated diseases. It has proved very attractive and become extremely popular during recent years. This opinion would extend the meaning of the word "deficiency" beyond reasonable limits. In the

present state of knowledge it seems most convenient to retain the existing nosological scheme.

The report of the joint committee appointed by the Lister Institute and Medical Research Committee briefly summarizes the distribution of the vitamins in our common natural foods, as follows: "Broadly speaking, it is safe to say that the individual always finds a sufficient supply of vitamins in his food, so long as that food is reasonably varied and has received no artificial or accidental separation into parts, and so long as no destructive influence has been applied to it."

I. BERI-BERI.

Preventive Treatment.—The prophylaxis of beri-beri is in theory a very simple matter, but in practice it is often attended with difficulty. The disease is chiefly prevalent among the native populations of tropical and sub-tropical countries, and is caused by the great degree of dependence, among such peoples, upon highly milled or polished rice as a national food.

It occurs also in prisons and other institutions in such countries, and among troops and sailors whose ration consists largely of decorticated rice and is deficient in other respects. Beri-beri is therefore in the strictest sense a dietetic disease, and its prevention depends upon the correction of dietary faults. The recognition of these facts, which began in Japan with the reform in the ration of the navy towards the close of the last century, rapidly spread throughout the Orient; it has been followed by a remarkable diminution in the occurrence of the disease in many districts in which it was, until recently, prevalent and its complete disappearance in others. These results follow the substitution of an undermilled rice for the polished or decorticated rice in general use or the addition to the diet of peas, beans and barley, which contain considerable amounts of fat-soluble *A*, as well as water-soluble *B*, or cereal grains and leafy vegetables, which contain water-soluble *B* in great abundance. The poorest classes, who live on an almost exclusive diet of milled rice and fish, suffer most from beri-beri. Those escape it who are able to add to such a diet almost any natural food, but to this statement must be made the exception of starches, sugars, syrups and fats and oils, which do not contain water-soluble *B*.

Bolted wheat flour, degerminated corn meal and decorticated rice are foodstuffs very poor in this dietary essential. These measures, the use of coated rice or the addition of legumes or of fresh leafy vegetables to a rice diet, have been successful among troops and in prisons and other institutions under government control, but their enforcement among ignorant native peoples for a time proved difficult. The well-known instances of the Straits Settlements, the native scouts in the Philippine Islands, and the Culion Leper Colony in which, under strict precautions, the substitution of undermilled for polished rice was promptly followed by the disappear-

ance of beri-beri, are concrete examples of the effect of this correction of a dietary fault.

Among the measures to be instituted in districts in which the ignorance of the civil population stands in the way of dietary changes necessary to prevent beri-beri are education, governmental encouragement of the sale of undermilled rice, and a prohibitive tax upon the polished article. In order to secure rice in which a sufficient part of the pericarp remains, samples of commercial lots must be systematically tested. This is done (1) by the use of Gram's iodine solution, which acting upon the starch, wholly blackens the exposed grain from which the pericarp has been removed, but leaves the surface of those portions of grains upon which the outer layer remains of the natural yellowish white or red color. (2) By a chemical determination of the phosphorus content of a given sample. The phosphorus pentoxide is chiefly present in the cortex of the grain and any rice showing 0.4 per cent. of this mineral salt has enough of the pericarp remaining to be safe against beri-beri.

In institutions it is not difficult to arrange a suitable ration to overcome the effects of neuritis-producing rice. Barley, mixed with such rice in the proportion of one to two, or the addition of peas or beans to the ration in the proportion of one to four, suffice. But such a ration becomes very unacceptable after a time, and there are always persons who will refuse it. It has been found that beri-beri ceases to occur in institutions and bodies of men under discipline when the ration consists of undermilled rice, or whole wheat bread or whole corn bread, peas or beans served once a week, barley soups, fresh meat twice a week, and occasionally eggs or milk. In eastern countries dairy products are not always easy to procure, especially among the poor. Meats and vegetables should not be too much cooked and canned foods should be avoided.

Expectant and Symptomatic Treatment.—If the deficiency in the diet be corrected early in the course of the attack, recovery gradually occurs and may be complete in a few weeks. The onset, however, is often insidious, and the changes in the nervous system have made such progress by the time the nature of the disease is recognized that recovery may be very slow, often extending over a period of months. Rest in bed, a varied nutritious diet, saline purgation, bromides and anodynes for the relief of pain, digitalis in efficient doses are indicated. Bleeding may be necessary to relieve an embarrassed heart. It has the sanction of many authorities. Upon the subsidence of dropsy, massage, passive movements and electricity may hasten the recovery of the wasted muscles.

Curative Treatment.—Beri-beri as a dietetic disease demands correction of the diet for its cure. Yeast may also be given or rice polishings. An extract of the latter is much used in the Philippines especially in the treatment of children.

The general mortality is about five per cent. In the more serious cases admitted to hospitals it is about twenty per cent. In some outbreaks it has been reported to be as high as fifty per cent. or more.

II. SCURVY.

Scorbutus.

Preventive Treatment.—Scurvy is a dietetic disease and its prevention and its cure alike depend upon the correction of dietetic faults. What these faults are and the means by which they can be corrected have been well known for more than a century; and the disease, which was the scourge of the seas in the days of long voyages and an insufficient ration of salt meat, sea biscuits and tea; of armies, with the lack of fruits and fresh vegetables; and of workhouses and prisons where the diet was monotonous and scanty, is almost unknown to physicians of the present time. In fact, when a sporadic case now occurs as occasionally happens among people of means, in consequence of a diet faulty through ignorance, although the symptoms are most manifest and severe, the diagnosis is frequently in doubt, and outbreaks of scurvy sometimes arise in institutions as the result of neglect to provide necessary antiscorbutic foodstuffs.

The essential nature of these foodstuffs may be summed up in the word "freshness" or a state of preservation in which the quality of freshness and due proportion of the vitamine "C" are maintained. A diet which includes fresh vegetables and fruits will prevent the development of scurvy. The prophylactic value of such a diet is only to be known in these days of rapid transportation, shorter voyages, cold storage facilities, and a scientific knowledge of methods of preserving perishable foods, to be secured under almost all circumstances. The regulations of the Board of Trade requiring a sufficient supply of antiscorbutic articles of diet to form part of the provisioning of every ship has practically brought scurvy among seamen to an end.

The prophylactic power against scurvy exists in a high degree in oranges and lemons. An ounce of the juice of either, given daily to adults on a scurvy-producing diet, is sufficient to prevent the disease. Lime juice is of inferior value. Apples and grapes are useful and it is probable that most acid or subacid fruits in the fresh condition or properly preserved are antiscorbutic.

Potatoes, turnips, carrots, onions, cabbage and other vegetables in the fresh state are preventive. Sauer-kraut is particularly useful. Lettuce, endive, cresses, leeks and other leafy vegetables used as salads are of great value and should be, whenever practicable, added to the diet. Fruits and fruit juices that have been subjected to heat for the purpose of preserving them, and vegetables that have been dried or boiled for a long time, lose their antiscorbutic value. It is for this reason that canned articles of food are mostly without value in preventing scurvy. To this statement an exception must be made in regard to canned tomatoes, cabbage and sauer-kraut. When any vegetable used as an antiscorbutic is to be cooked, the exposure to heat must be as short as possible and soda must in no case be used, since it has been found by experience to destroy the antiscorbutic

value. Fruit juices must be preserved with alcohol. Fresh meat and milk are to some extent useful as preventives, but much less so than fresh vegetables and fruits. Scurvy has frequently occurred under circumstances in which fresh meat has been supplied. On the other hand, there are many authenticated instances of the prolonged subsistence of hunters, explorers and Indians upon an exclusive diet of fresh meat without developing scurvy.

The explanation of this apparently exceptional fact is to be sought in the nature of the food of the animals from which "wild" meat is procured; and is in accord with the recent observation of Hess and others that the antiscorbutic value of milk varies greatly according to the fodder of the cow. This observer found that "cows that had been for three weeks on a fodder which was almost completely devoid of antiscorbutic vitamine, produced a milk that was almost devoid of this factor, although of normal caloric value and adequate in its fat, protein, and carbohydrate content."

Dried peas, beans and lentils are without antiscorbutic value. When however, they are caused to germinate by exposure to moisture and heat, under certain conditions, and not allowed to dry, but rapidly cooked, they develop active antiscorbutic properties.

Expectant-Symptomatic Treatment.—If the diet be not corrected by the addition of antiscorbutic articles of food in sufficient quantities, no case of scurvy shows a tendency to recover. There is no such thing as an expectant treatment. On the contrary, the progress of the disease tends more or less rapidly to ultimate dyscrasia and death. When, however, fresh vegetables and fruits or other antiscorbutic foods are added to the diet, the results are prompt and spectacular. All the symptoms of a loathsome and disabling disease pass away and the patient rapidly recovers his former appearance of health. It is important to note that a return to the former deficient diet is at once followed by the reappearance of the symptoms, and lesions of the disease, which develop much more rapidly than when they first appeared.

Symptomatic treatment, such as the use of opium or its derivatives for the relief of pain and sleeplessness, the administration of laxative enemata, the use of fresh raw milk and soups, fresh fruits and fruit juices, meat and vegetables that have been scraped, on account of the condition of the gums which prevents chewing, enter into the management of individual cases. Active purgatives, especially calomel and other mercurials are dangerous. Ulcers are to be treated in accordance with surgical principles.

The prognosis as to life is extremely unfavorable unless antiscorbutic food can be administered, although men differ greatly in powers of resistance to scurvy, the fatal issue occurring much earlier in some cases than in others. Even in advanced cases, the proper diet proves rapidly efficient not only in the arrest of the progress of the disease but also in the correction of the wasting ulceration and nephritis. When ankylosis and contractures have occurred, they must be treated as surgical affections after the general health has been restored. The graver aspects of scurvy are rarely observed at the present time. McCollum holds the view that scurvy is due to stale

food and "that there is no protective substance against scurvy in the sense that there is against beri-beri." On the other hand, Hess, Vedder and other recent authorities on dietetics unqualifiedly endorse the "antiscorbutic vitamine" theory of Funk.

III. INFANTILE SCURVY.

Barlow's Disease.

Preventive Treatment.—Infantile scurvy is a dietetic disease and its prevention and cure consist in the proper administration of antiscorbutic articles of food suitable to the age of the patient. It has long been known that a few spoonfuls of orange juice, given daily, to an infant suffering from scurvy will in a short time wholly relieve the symptoms of the disease and cause the lesions to disappear. It is only recently, however, that certain facts in regard to infant feeding and the natural history of the disease, which have an important bearing upon its prevention and treatment, have come to light. The proper food for infants is human milk, which contains all the elements of nutrition, including the antiscorbutic principle. But this food varies with the woman's diet, and in consequence of ignorance or poverty, may be wholly deficient in the dietary essential, and it has happened that breast-fed babies have developed scurvy. This unusual occurrence is more liable to take place toward the end of the winter months during which fruits and fresh vegetables are beyond the reach of the poor, and there is abundant evidence that neither human beings nor other animals can either synthesize or store up the antiscorbutic substance.

The only practical substitute for human milk is that of the cow, modified in physiological principles. This food, likewise varies with the food of the animal, and in the absence of fresh substances in the fodder, the winter milk of stall-fed cows may be so lacking in the antiscorbutic element as to favor the development of scurvy in the babies to whom it is fed. The relatively small antiscorbutic value of good cows' milk is further reduced by dilution in the modification formulas. The opinion formerly generally held, that the application of heat destroys the antiscorbutic principle in various foods, is not wholly correct. The length of the exposure is now known to be more important than the degree of the temperature. Milk heated to 145° F. for thirty minutes loses more of its antiscorbutic value than milk heated to 212° F. for a few minutes; and milk dried and sterilized by exposure for a few seconds upon a surface heated to 280° F. retains its potency (Method of Just and Hatmaker). It thus appears that the antiscorbutic element not only withstands brief exposure to high temperature but also resists rapid desiccation. It is a matter of clinical experience that scurvy is more likely to develop upon a diet of pasteurized milk than upon a diet of boiled milk; and one of the more important causes of increased scurvy in infants in cities is the custom among dealers of pasteurizing milk to keep it from souring. By this process, the lactic-acid-producing organisms are destroyed, but the subsequent unrestrained development of

putrefactive organisms, which results, adds a new danger to the milk as a food. Fresh milk, boiled for a short time before feeding, avoids both of these sources of risk. Dried milk and sweetened condensed milk packed in hermetically sealed bottles retain the antiscorbutic quality, but lose it after exposure to the air. This quality is preserved by foods which are acid, such as orange juice, to a much greater degree when exposed to a high temperature than those of a neutral or an alkaline reaction. In general, canning is destructive of the antiscorbutic principle, but to this rule there are exceptions of which the chief are milk and the tomato. The latter is not to be considered as a food for infants, though tomato juice may be used as an antiscorbutic when other articles are not to be obtained. Stale foods of almost every kind lose their antiscorbutic power. Whether this loss is due to oxidation or to some other chemical processes slowly developed in aging is not at present clearly understood. It is absolutely necessary, in view of the foregoing facts, that in the artificial feeding of infants the source and quality of the milk should be carefully considered; that canned and proprietary foods should be avoided insofar as possible; that a monotonous diet should be varied; and that the administration of orange or other fruit juices, carefully prepared vegetable broths, scraped apple, potato water or potato cream should be gradually added to the list of foods.

Orange juice properly dried retains its antiscorbutic property. Fresh carrots and spinach, dehydrated with minimum vitamin destruction, and finely powdered (Method of Beebe) are now sold in the shops. These vegetable powders contain sufficient mineral, enough cellulose to have a slight laxative effect, and may be added to other foods.

There are facts in the natural history of infantile scurvy, formerly little understood, which have an important bearing upon the treatment of the disease. Fully developed cases are rarely encountered earlier than the age of six months; their greatest incidence is at ten months; less frequently they are first met with in the second year of life. The dietary deficiency may be slight and only gradually cause marked symptoms, or there may be some degree of immunity acquired from the mother. There are few predisposing influences where the diet is not lacking in the antiscorbutic factor. Infantile scurvy is more common among the well-to-do, but prevalent among the poor; somewhat more frequently encountered in cities, but often met with among the children of country people. It is, at the present time not especially an institutional disease. A diet inadequate in quantity, or unsuited to the individual child in other respects, does not cause scurvy unless it is deficient also in the antiscorbutic quality. Hereditary syphilis, tuberculosis and other nutritional diseases may coexist with scurvy, but they cannot be regarded as concomitant causes.

The clinical picture of outspoken scurvy in children is characteristic. The association of hemorrhage from mucous surfaces, ecchymosis, circumscribed tumefaction of the lower limbs from subperiosteal hemorrhage, the pseudo-paralytic attitude of the child, its dread of being handled, fretfulness, pallor, œdema of the eyelids, and of the tissues overlying the long

bones, constitute a complex not seen in any other affection, and render the diagnosis a comparatively simple matter. The rapid subsidence of such an array of morbid phenomena which follows the addition of the lacking anti-scorbutic element of the food constitutes a true therapeutic test and at once confirms the diagnosis.

But this condition does not develop at once. There is a period of uncertain duration measured by weeks, perhaps by a month or more, in which pallor, fretfulness and other evidences of malnutrition are the only signs of the developing disease. The child eats enough, but in the language of the nurse, its food does not nourish it. Among people of means, who can afford expensive artificial foods, matters too often go from bad to worse; but with those who place the child on a high chair at the table, and let it have what it can reach, which is not much, or what the other children give it, maybe a spoonful of orange juice or a little mashed potato, fully developed scurvy does not so often occur. The child recovers because its food is more or less rapidly changed. For this reason the sick rate from scurvy among infants can never be known. The death rate is low, and reported autopsies are few in number. The prognosis as to complete restoration to health is, in absence of concurrent serious disease, highly favorable. A knowledge of scurvy in infancy, its causation, prevention and cure should be regarded as a matter of alimentary hygiene to be acquired by professional nurses, social workers and prospective mothers.

IV. PELLAGRA.

The researches of Goldberg, Wheeler and Sydenstricker (1916-1920) have cleared up many of the obscurities in regard to the etiology of pellagra and established the fact that it is a dietary disease. In the words of Goldberg "the exact dietary factor or factors constituting the specific pellagra-producing fault is undetermined, but is to be sought in some one or some combination or combinations of the following:

"(a) A physiologically defective protein (amino-acid) supply. (b) A defective or inadequate mineral supply. (c) A deficiency in an as yet unknown dietary essential (vitamine?)."

In this sense pellagra is properly classed in the group of deficiency diseases.

Preventive Treatment.—Pellagra is a community disease, not because it is transmitted from person to person, but because it is due to dietary faults extending throughout the locality or district in which it occurs; it is a disease of poverty and the ignorance which is associated with poverty, because of the restrictions and limitations of the diet which such conditions enforce; and it is a disease of seasonal recurrence, because the dietary faults are greater during the winter and early spring than at other seasons of the year. It is to be noted in this connection that nurses, attendants and other employes resident in asylums, prisons and other institutions in which cases of pellagra in every stage of development are present, and who are in more

or less constant association with such patients, very rarely develop the disease. This immunity has been found to be associated with radical differences in diet.

In theory, the prevention of pellagra consists in the general use of a diet which comprises, in adequate amounts and suitable condition, all the elements of natural foods required by the body for its normal growth and activities. In communities and institutions in which such a diet is generally available, pellagra does not occur.

In practice the very conditions which cause the disease stand in the way of its prevention, which can only be reached by the diffusion of knowledge concerning its cause, an improvement in conditions of living, betterment in wages and general social uplift.

In the absence of an exact knowledge of the specific deficiency, it is important to improve the diet of those manifesting the symptoms of the disease, by the addition to their ordinary food of a sufficient quantity of animal protein, an adequate supply of food minerals and the articles of normal foodstuffs which contain the recognized dietary essentials, in addition to carbohydrates, fat and protein, required to sustain life. The available animal portion is obtained by the use of milk, lean meat, eggs and cheese. The mineral elements are obtained from green vegetables, such as cabbage, spinach, turnips, stringbeans, lettuce, leeks, onions, cauliflower, and such fruits as lemons, oranges, grapes, apples, peaches and prunes.

Such additions to the diet in reasonable amounts supply certain vitamins and they contain an antipellagrous element which may be found to be specific.

Maize as a monotonous and chief article of diet, unduly prolonged, may be the cause of pellagra but this is also true of the endosperm of the seeds of other plants. A monotonous diet of corn bread, pork and molasses, varied occasionally with sweet potatoes, and deficient in milk, eggs and leafy vegetables kept up throughout the winter months is common in pellagrous districts.

Expectant-Symptomatic Treatment.—In the absence of proper dietetic measures all remedies fail. There is no such thing as an expectant treatment. Nor indeed, when proper additions to the diet as indicated in the foregoing paragraphs are not made, is symptomatic treatment of much service. Troublesome stomatitis may be relieved by a detergent mouth wash; diarrhoea is best treated by a proper diet. Associated diseases and complications are to be treated in accordance with general medical principles. The skin lesions must be protected against infection.

Curative Treatment.—Many drugs have been used but there is no concurrence of opinion as to the value of any of them. Apparently, favorable results have been due to dietary measures instituted at the same time rather than the remedies prescribed. The disappearance of symptoms in favorable cases is not to be looked upon as indicating a permanent restoration to health, unless the improvement in diet is also permanent.

The mortality is, generally speaking, about ten per cent, but many of the milder cases are not recognized. In severe cases the prognosis should

be guarded. Great exhaustion, persistent vomiting or diarrhœa, indications of serious central nervous disease, and a very extensive eruption, especially with much ulceration, are of grave prognostic omen.

V. RICKETS.

Rhachitis.

There is little to add to the clinical description of this disease by Gilsson (1650) who suggested the term *rhachitis* from *ῥάχις*, the spine, because it was early affected. Before and since that period the popular designation has been rickets from the old English *wrick*, twist. Fuller (1647) wrote. "There is a disease of infants and an infant disease, having scarcely as yet got a proper name in Latin, called the rickets; wherein the head waxeth too great, whilst the legs and lower parts wain too little." Since that time much has been done in connection with the pathology so that our knowledge of the disease is now fairly complete. But its causation remains obscure. Rickets is a nutritional disease of childhood. It derives importance from the frequency of its occurrence, especially among the poor of the great cities who are badly housed and improperly fed; from the striking clinical picture which it presents; and from the fact that it is a preventable and, under proper management in its early stages, a readily curable affection.

It has been estimated that fully seventy-five per cent. of the children in the cities of the temperate zone suffer from rickets in its latent or outspoken forms. The prevalence in Central Europe, during the late war, was practically epidemic, amounting in some localities to one hundred per cent. of the children, many of whom were breast-fed. In the United States it is also extremely common, especially among the children of the negro settlements, and those of Italian immigrants. Notwithstanding its extreme frequency, there is no evidence that the disease is hereditary in the ordinary sense. It is true that in rare instances children have been born with unmistakable signs of rickets, but in view of recent studies in nutrition such an occurrence finds its readiest explanation in a faulty diet of the mother, particularly when associated with overwork or ill health. It has occasionally been observed that among well-to-do families, where there may be several children, the older ones being wholly unaffected by rickets, the younger, born toward the close of the childbearing life of the mother, have become rickety.

Rickets first shows itself somewhere between the third and tenth month of life. It is of gradual onset, the earlier manifestations being excessive perspiration especially about the head, and at night restlessness and a disposition to throw the bedcovers off, fretfulness and a marked disinclination to be moved, protuberance of the belly, diarrhœa, and a peculiar tendency to catarrhal bronchitis at the eruption of the teeth, which appear late and irregularly and are often carious. The child is puny and flabby, languid and quickly tired. At this early stage, the true character of the disorder is not

often recognized. The mother attributes the fretfulness and ill condition to "teething" and consoles herself with the thought that other children have like troubles and get better when they cut their teeth, not associating these symptoms with the later and more serious manifestations of the disease. A considerable proportion of the milder cases are arrested in this stage, the dietary conditions improving as the teeth appear, and the opportunities for sunlight and fresh air increasing with the age of the child. Many of the cases of rickets are therefore overlooked.

As the disease progresses the skeletal lesions appear, failure of the fontanelle to close, bossing of the bones of the skull, craniotabes, *caput quadratum*, the rosary, chicken breast, spinal curvatures, enlargement of the long bones about the epiphyses, bending of the shafts, sometimes fractures, bow-legs, knock-knees, flat-foot, deformities partly due to inability of the softened bones to bear the weight of the body, partly to muscular action, partly to relaxation of the ligaments.

The duration of rickets varies according to circumstances. Under proper treatment the nutritional faults may be corrected in the course of a few weeks, and recovery takes place without deformity. When treatment is instituted later, the disease may last months; many of the deformities are then permanent. The degree to which recovery in this respect is gradually overcome is, however, remarkable. The extent and progress of the skeletal lesions may be accurately studied by means of the x-rays.

In the light of present day research, the older theories of the causation of rickets have been abandoned. A lack of lime or phosphorus in the food, or the presence of lactic or other acid in the fluids of the body, are rejected hypotheses. Want of sunlight and fresh air, confinement in unwholesome quarters and defective hygiene in general, play an important part in the etiology of rickets as predisposing factors, but do not cause it. Antecedent debilitating diseases as the infections and especially congenital syphilis are also merely predisposing causes. The evidence that rickets is a nutritional disease is conclusive. In other words, it is a deficiency disease. The diets of children suffering from this disease show too little animal fat, too little protein, and an excess of carbohydrate; and the articles in which this want of balance stands out conspicuously are the milk of the overworked or underfed mother, or after too prolonged nursing, or diluted cow's milk, when these are eked out by various farinaceous articles, condensed milk, or the proprietary foods for infants. A diet defective in these particulars undoubtedly gives rise to various derangements of nutrition and predisposes to gastro-intestinal infection, but that such a diet is the actual cause of rickets cannot be demonstrated. The attention of investigators, alike in the laboratory and the clinic, is at the present time directed to the vitamine theory as the probable solution of the question of the actual cause of rickets. The experimental investigations of Mallanby, who used puppies for the purpose, appeared to support the view that a special dietary deficiency is the cause of the disease, and that the substance in default is similar to, and probably identical with, fat-soluble A. The clinical studies of Hess and Unger

have brought these conclusions into question. These observers, while admitting that fat-soluble A "may be a factor in the etiology of rickets," claim "it is not the dominant factor in its pathogenesis." These studies are of great practical importance since they show that the fat-soluble A, as it exists in milk, is not the antirachitic factor; nor will a diet largely composed of milk prevent the development of rickets, nor a small amount cause it. They also show that cod liver oil, when given in sufficient amounts, cures the disease and that this substance differs from milk as to its antirachitic content not only quantitatively but also qualitatively. In this connection the well established fact that the tendency of cod liver oil in rickets is to cause calcium retention, while large amounts of milk produce a negative calcium balance, is of importance.

Preventive Treatment.—Rickets, the offspring of poverty and ignorance, is so widely prevalent, that its general prevention is a formidable undertaking. But it is not a hopeless one. What can be readily done for an individual child or a single family of children is possible for the child collectively. The people know that it is better to have rosy, straight-limbed babies who laugh and cry and use their muscles, than wretched, pallid, puny children, fretful without apparent cause, whining when they are handled, and growing feebler and more deformed from week to week. But what they do not know is, How? To tell them how is the first step toward the prevention of rickets. This is the task now being solved by child welfare workers in every civilized community. It is a sign of interest in our own country that The American Child Hygiene Association in the eleventh year of its existence now numbers 2,200 members. Agencies such as these make it part of their work to invade the rickety districts with knowledge and help. The prospective mother and the nursing mother are shown the necessity of wholesome living and nourishing food. For the babies, the breast, but not solely for too long a time. As the teeth come, the dietary is gradually extended; a spoonful of orange juice, a little vegetable soup, something to chew upon and suck, a chicken bone or a chop bone with a tiny shred or two of meat left on it; later, pure freshly pasteurized cow's milk, a little baked potato with butter, oatmeal porridge with cream, milk toast, the powdered yolk of a hard boiled egg with a little butter—never oleomargarine. For mother and child, better housing, more sunlight and fresh air, out-of-doors and a well balanced diet are the desired factors for prevention. The daily bath and long hours of undisturbed sleep, are easier for the child than the mother to obtain.

The remarkable increase and severity of rickets in the spring and its milder character and diminished incidence in the late summer and autumn are doubtless to be explained partly by the greater confinement of infants indoors during the winter and the character of the food of both the mother and the child, and partly by the general improvement in hygienic conditions a greater degree of out-door life, and a much more varied diet in the late spring and summer. Even in the matter of milk, there is great difference in

the antirhachitic content of the milk of fodder-fed cows in winter and that of the same animals at pasture in the summer and autumn.

If the baby shows symptoms of oncoming rickets, fretfulness without obvious cause, excessive sweating, restlessness in bed, cod liver oil must be given at once. This animal fat is rich in antirhachitic substance, and when given in suitable quantities is promptly and permanently curative. Hess has estimated that by the expenditure of \$100,000 a year for cod liver oil, rickets could be practically abolished in the city of New York.

Symptomatic Treatment.—The early manifestations are relieved by the hygienic and dietary measures described in the foregoing paragraphs, especially when carried out in connection with the use of cod liver oil, which may be given in a freshly-made emulsion. Even when the disease has made some progress and skeletal deformities have begun to appear, rapid improvement may occur. Intercurrent diseases must, of course, receive due attention.

In more advanced cases care must be taken that postures and movements that tend to increase deformities should be avoided. Changes of position must be made at short intervals. Kyphosis and lateral spinal curvatures may be averted by frequent change from the sitting to the lying posture, bending of the long bones of the lower extremities by avoiding the frog-like attitude which the weakness of the legs and thighs inclines the child to assume. As the deformities tend to diminish as the nutritional fault is corrected, it is important to check their development as far as possible. In grave cases the child must be kept lying upon a bed or pillow and not allowed to sit up at all; but his posture must be changed at short intervals by turning him from side to side, changing his pillows and altering the position of his limbs. Gentle massage and passive movements are of great importance. There is much difference of opinion as to the use of steel braces, which should never be applied except under the direction of an orthopædic specialist.

Curative Treatment.—Removal, insofar as is possible, of the insanitary conditions which predispose to rickets, and adjustment of the diet in accordance with the needs of the individual child are essential, and in many cases sufficient. That the antirhachitic substance is present in many animal fats and in abundance in cod liver oil is now fully established.

It is probable that the improvement following the use of various drugs, such as the elixir of phosphorus and syrup of iodide of iron, has been due to the correction of faults of living and diet, and the addition of cod liver oil to the dietary at the time of the treatment by these medicaments.

Hess and Unger influenced by the results of treatment by ultraviolet ray, have recently used the direct rays of the sun in the treatment of rickets. The usual technic of heliotherapy was employed. The number of cases was limited, but in every instance decided improvement was shown by the Röntgen ray in rapid calcification of the epiphyses and in other rickety manifestations as the rosary and muscular weakness. The action appeared to be systemic. These investigators regard their results as having an impor-

tant bearing upon the seasonal variation in the incidence of rickets, and regard sunlight as a hygienic factor of importance in the management of the disease.

Huldschinsky¹ was the first to institute systematic attempts at the treatment of rickets with artificial ultraviolet light (the Hanau system).

The technic of irradiation is very simple. Treatment is given three times a week, the anterior and posterior surfaces of the body being alternately exposed to the rays, consideration being given to protecting the eyes. The distance between the lamp and the child should at first be maintained at 100 cm., gradually this distance may be reduced to 60 cm. The first sitting should be for three minutes, and each sitting may be increased by from one to three minutes until the maximum of from twenty to thirty minutes is reached. After a course of treatment covering about four weeks, it is advisable to omit irradiations for from eight to fourteen days, and in severe bedridden cases, to begin a new series of sittings. As a result of the exposure, an erythema usually develops, gradually resulting in increased pigmentation of the skin. If the distance between the lamp and the body is not sufficient, or if the patient has cutaneous hypersusceptibility, a harmless burn of the skin may be produced. It is always advisable, therefore, to reduce the distance very carefully. Dietetic treatment is unnecessary during the phototherapeutic course. On the hypothesis that the diseased bone required from 30 to 60 grams of calcium, Huldschinsky at first prescribed calcium phosphate, 1 to 1.5 gram daily. If the diet was rich in calcium, this prescription proved superfluous. It is advisable to prescribe calcium only in those cases in which the diet is very low in calcium, as breast milk or butter and flour gruels.

Huldschinsky summarized the results of ultraviolet irradiation in the following sentences:

1. The therapeutic effect of quartz light irradiation is invariably apparent in all forms of rickets.
2. Recovery results more promptly than with any of the methods employed heretofore.
3. The effects of irradiation are lasting and the regenerative process is active for at least two months after interruption of treatment.
4. The duration of treatment embraces (a) from two to four weeks in infants, (b) from one to two months in children aged one year, (c) from two to six months in children aged two to four years, and (d) up to nine months in older children.

Huldschinsky demonstrated röntgenographically that calcification of the bone paralleled the clinical improvement.

Rickets is not, of itself a fatal disease, but children suffering from it bear intercurrent diseases badly and are especially liable to succumb to affections of the respiratory system. They are also liable to convulsions which, not rarely, cause death.

¹ International Clinics, J. B. Lippincott Co., 31st Series, Vol. IV, 180.

XI.

THE TREATMENT OF DISEASES OF THE DIGESTIVE SYSTEM.

I. DISEASES OF THE MOUTH, LIPS, TONGUE,
TONSILS, PHARYNX, UVULA, SALIVARY GLANDS,
AND ŒSOPHAGUS.

J. R. DAVIES, JR.

i. Diseases of the Mouth.

(a) ACUTE STOMATITIS.

THOROUGH sterilization of the nursing bottle is an important preventive measure since this morbid state occurs most frequently in bottle-fed infants. The baby's mouth should be washed with a saturated solution of boric acid after each feeding. The latter can be done by wrapping a small pledget of cotton around the finger and moistening it with a solution of boric acid. The mother's nipple should be cleansed with a boric acid solution before each feeding in breast-fed infants.

Acute stomatitis due to the excessive use of alcohol, tobacco, and highly seasoned foods usually remedies itself when the exciting cause is removed.

A saturated solution of boric acid is probably the most useful mouth wash. *Liquor antisepticus alkalinus*, diluted with three parts of water, is very soothing. Should ulceration occur, the application of a ten per cent. solution of silver nitrate will stimulate healing. If fever is present, especially in children, some mild fever mixture containing potassium citrate is useful.

The immediate treatment of acute stomatitis, due to the ingestion of strong acids or alkalies, demands the proper neutralizing agent as a mouth wash. After-treatment depends upon the subsequent state of the individual.

(b) FOLLICULAR (APHTHOUS STOMATITIS).

This malady is often confused with thrush, but is not identical. It usually follows indigestion or one of the acute febrile diseases. The regulation of the diet and the proper care of the mouth and teeth will help to prevent it.

A mouth wash of boric acid, or potassium chlorate is very beneficial. If the ulceration is persistent, silver nitrate in ten per cent. solution applied to each ulcer will frequently stimulate healing. If there is an underlying anæmia a tonic such as the syrup of the iodide of iron should be administered.

(c) ULCERATIVE STOMATITIS.

The preventive treatment consists in the proper care of the teeth and the general hygiene of the mouth. A saturated solution of potassium chlorate is one of the satisfactory mouth washes. If the odor is offensive, a 1-10,000 solution of potassium permanganate may be used. Local ulcers should be touched with a ten per cent. solution of silver nitrate.

(d) THRUSH (PARASITIC STOMATITIS).

This occurs most frequently in young children and the proper hygiene of the nursing bottle and the baby's mouth will prevent it.

The mouth should be frequently cleansed with an alkaline solution. Bicarbonate of soda, a teaspoonful to a glass of water, potassium chlorate in saturated solution or potassium permanganate 1-10,000 solution are probably the most effectual. General treatment is of the utmost importance. Good hygiene, regulation of the diet and the use of suitable tonics are necessary. Syrup of the iodide of iron is an adequate tonic.

(e) DIPHTHERITIC STOMATITIS.

The administration of antitoxin will remedy a pseudomembranous stomatitis.

(f) GANGRENOUS STOMATITIS (NOMA; CANCRUM ORIS).

This is occasionally a complication of some of the infectious diseases of childhood, notably measles; less frequently, scarlet fever and typhoid fever.

The gangrenous area should be cauterized. The diphtheria bacillus is sometimes present; therefore the administration of the antitoxin may be beneficial. Irrigations of potassium permanganate should be used to destroy the fetor. Supportive treatment such as whiskey, strychnine and a nutritious diet are important measures.

(g) MERCURIAL STOMATITIS (PTYALISM).

The prevention is most important. If an alkaline mouth wash is prescribed for those individuals to whom mercury is to be given internally for a more or less extended period, this objectionable untoward symptom will be frustrated in a majority of instances.

However, ptyalism infrequently occurs in patients to whom but a very small portion of the drug has been given, or not rarely in workers whose occupation necessitates more or less constant handling of the metallic substance. The inhalation of the fumes of mercury is also causal. When a minimal dose is responsible, its recurrence can be obstructed by non-use of the drug. If an occupation is accountable, it must be stopped, at least until the morbid state has been fully corrected.

When the first evidence of ptyalism shows itself, the drug must be plucked from the medication, or the worker removed from the occupation.

The mild cases need no special measures except omission of the drug

and the substitution of mouth washes. A saturated solution of potassium chlorate is one of the best oral cleansing remedies. Potassium chlorate may be of service when administered internally in doses of 0.6 gram (10 grains) three or four times per diem.

Careful attention must be given to appropriate feedings. Suitable and nutritious food is demanded—milk (and its modifications) is ideal.

The intestinal tract should be thoroughly emptied, if it has not already been. A saline aperient is by far the most eligible evacuant.

Elimination is most essential, and hot baths do admirably when the general physical condition will permit.

Potassium iodide in rather free dosage will aid materially in removing the poisonous mercury from the body.

Atropin, 0.0005 to 0.001 gram ($\frac{1}{120}$ to $\frac{1}{60}$ grain), is frequently used when the secretion is too plentiful.

Pain, when severe, requires in some form that wonder agent, opium. Supportive measures may be imperative, and the use of tonics in varied forms is gainful during the convalescent period.

ii. Diseases of the Lips.

(a) MALFORMATIONS OF THE LIPS.

The treatment is either surgical, with electricity, or by the use of radium or x-ray; therefore the reader is referred to the text-books on these special subjects.

(b) HERPES LABIALIS.

This condition is oftentimes associated with colds, pulmonary diseases and in many cases is purely neurotic in origin.

Camphorated cold cream, spirits of camphor or some similar evaporating application is usually sufficient.

(c) ECZEMA OF THE LIPS.

Calamine and zinc oxide ointment will be found useful. A treatise on skin diseases should be consulted.

(d) CARBUNCLE OF THE LIP.

This is a very serious malady and requires strenuous methods in its treatment. A crucial incision should be made and the diseased area curetted away. The cavity should then be sterilized with pure carbolic acid or dichloramine-T and packed with iodoform gauze. Stimulating and supportive treatment will be necessary. Some surgeons advise complete excision.

(e) CHANCRE OF THE LIP.

Prompt general syphilitic treatment usually results in the disappearance of the chancre. The part should be kept clean and a dusting powder

such as calomel or bismuth subnitrate, used. In very rare instances it may be necessary to destroy the chancre with nitric acid.

(f) CARCINOMA OF THE LIP.

This is a surgical process, and resort to a surgical text-book should be taken.

Radium and the x-ray should be used in conjunction with surgery whenever feasible. Morphine for the relief of pain is advisable in the terminal stage.

iii. Diseases of the Tongue.

(a) ACUTE GLOSSITIS.

Usually an antiseptic mouth wash and the use of cracked ice is sufficient treatment. Should suppuration occur, incision is required.

(b) PAPILLITIS LINGUALIS.

The electric cautery should be used on the ulcers.

(c) GEOGRAPHICAL TONGUE.

Applications of a ten per cent. solution of silver nitrate will usually relieve the intense itching.

(d) LEUKOPLAKIA.

The proper hygiene of the mouth is of vital importance. Tobacco should be prohibited, and carious teeth removed. Balsam of Peru, silver nitrate and salicylic acid are recommended.

(e) RIGG'S DISEASE.

The proper care of the mouth is of consequence. Diseased teeth when present should be removed. If an improper diet is responsible, it should be corrected. In persistent cases which do not respond to treatment with silver nitrate or tincture of iodine excision is in order.

(f) CARCINOMA OF THE TONGUE.

At the onset surgical intervention is the only treatment to be considered. When inoperable, radium and the x-ray may delimit the growth and control the pain. Morphine for pain and supportive measures are required.

iv. Diseases of the Tonsils.

(a) ACUTE TONSILLITIS.

The preventive treatment of acute tonsillitis is not dissimilar to that for acute "colds." The tonsils should be removed when they are the seat of repeated infections.

A thorough cleansing of the gastro-intestinal tract is a salient item in the general treatment. Calomel or blue mass followed by citrate of magnesia or Epsom salts ably solves this problem. Rest in bed and a liquid diet are urgently necessary during the acme of the infection.

Salicylates will be found of service in the majority of instances. There is no specific but a capsule containing acetylsalicylic acid 0.3 gram (5 grains), acetphenetidin 0.06 gram (1 grain) and dionin 0.004 gram ($\frac{1}{16}$ grain) given once an hour for four doses and then once every four hours will surely relieve in many instances the severe headache and general aching so pronounced in this disease. A mixture of Dover's powder 0.06 gram (1 grain) and sulphurated antimony 0.01 gram ($\frac{1}{6}$ grain) dusted on the back of the tongue every two hours, without water, is an excellent remedy. Potassium citrate is an agent not infrequently administered for acute tonsillitis. Tincture of aconite in 0.06 cc. (1 minim) doses is sometimes recommended in the early state. Following an attack of acute tonsillitis, tonic drugs may be serviceable.

The tonsils should be cleansed of the exudate by a cotton swab saturated with hydrogen peroxide before an antiseptic solution is applied or the drug will not penetrate to the inner portions of the crypts. Solutions of argyrol twenty per cent., or silver nitrate ten or twenty per cent. are useful. When the latter is applied the part should be rendered insensible by a local anæsthetic. Tincture of guaiac and compound tincture of benzoin are recommended by some clinicians. An alkaline spray or gargle should be used to cleanse and soothe the inflamed membrane. *Liquor antisepticus alkalinus*, Dobell's solution, or normal salt solution can be relied upon. An ice-bag applied to the throat will afford relief from the pain and lessen the congestion. A thin towel should cover the ice-bag lest chilblains develop. Lozenges containing potassium chlorate or guaiac may afford considerable relief. Occasionally astringent gargles are required.

The tonsillitis occurring in scarlet fever, Vincent's angina, diphtheria, etc., is covered thoroughly under treatment of these subjects and the student is referred to the respective disease in question.

(b) PERITONSILLAR ABSCESS (QUINSY).

The preventive and general treatment of this morbid state is similar to that of acute tonsillitis; the two conditions are nearly always associated, but not necessarily so.

The tonsils should be cleansed with hydrogen peroxide and painted with a silver nitrate solution as described in the treatment of acute tonsillitis. An alkaline solution such as Dobell's or *liquor antisepticus alkalinus* should be used as a spray or gargle, as hot as the patient can stand. As in acute tonsillitis, the ice-bag is most effectual in the relief of pain.

As soon as pus has formed and can be definitely located, it should be evacuated. By many it has been considered advisable to make an incision as soon as pus is suspected, without waiting for definite swelling, but in the

writer's experience this method has not produced a shortening of the course of the disease as some anticipate. The line of incision should be anæsthetized by equal parts of cocaine crystals and carbolic acid applied on a cotton swab. The incision should be made over the point of greatest bulging, which is usually a little above the junction of the uvula and soft palate and to the outer side of the inner edge of the anterior pillar. A thin curved bistoury is the best knife with which to make this incision. Frequently it will be necessary to insert a small closed hæmostat into the incision and open the blades upon withdrawal. The relief is almost immediate.

The diet must necessarily be light. Cold semi-solid foods such as custards and junkets are more easily swallowed than liquids.

The prostration following a peritonsillar abscess is most marked, and a stimulant such as whiskey, strychnine or nux vomica is necessary.

After the recovery the tonsils should be thoroughly examined and if ragged and diseased, removal should be advised, since each attack predisposes to a recurrence.

(c) CHRONIC HYPERTROPHIED TONSILS.

The surgical removal is advisable in most instances. The methods are many and varied. No matter what plan is adopted entire removal of the tonsil is paramount.

When operation is inadvisable because of some general condition, other measures than surgery must be adopted.

Painting the tonsils with such drugs as glycerite of tannin; a solution of iodine, potassium iodide and glycerine; or silver nitrate will not infrequently decrease the size of the tonsils and place them in a more healthful state.

The electric cautery is useful in destroying pockets that retain secretions and bacteria. This process is rather prolonged, but in elderly patients is of extreme value.

(d) ADENOIDS.

Whenever possible surgical removal should be the method of choice.

When operative procedures are not practical an astringent may be used in the nose. Probably the best is argyrol in twenty per cent. solution. It can be dropped into the nostrils once or twice a day. The general hygiene is important.

(e) HYPERTROPHY OF THE LINGUAL TONSIL.

Astringent solutions of silver nitrate, tannic acid or argyrol are of little value. The growth should be cocainized and then removed by means of a curved pair of scissors or by one of the special instruments devised for this work.

(f) LEPTOTHRICOSIS OF THE TONSIL (HYPERKERATOSIS).

This process is obstinate and resistant to treatment. It frequently lasts for several years, but is benign and need not cause alarm.

Thoroughly cleanse the tonsils with hydrogen peroxide in full strength and paint them with a solution composed of iodine 1.0 gram (15 grains), potassium iodide 3.0 grams (45 grains) to 30 cc. (1 ounce) of glycerine. An alkaline gargle should be used. The electric cautery may give excellent results.

The tonsils should not be removed until the condition has been cleared up since their removal is likely to spread the disease to the lingual tonsils and pharyngeal tissues.

(g) PAPILLOMA OF THE TONSIL.

Medical treatment is of little value. They may be removed by the electric cautery, but are usually best treated by surgical removal. The base of the growth can be anæsthetized with a ten per cent. solution of procaine and the growth snipped off with scissors. Probably it is always best to do a complete enucleation of the tonsil.

(h) LIPOMA OF THE TONSIL.

Unless these growths cause annoying symptoms, no treatment is required. If it is necessary to remove them, the complete extirpation of the tonsil is indicated.

(i) ANGIOMA OF THE TONSIL.

This is a rare state and is best treated by electrolysis.

(j) FIBROMA OF THE TONSIL.

The treatment is tonsillectomy.

(k) CYSTOMA OF THE TONSIL.

It is much more satisfactory to enucleate the tonsil, than to incise the cyst and swab it with carbolic acid.

(l) CARCINOMA OF THE TONSIL.

The treatment of malignancy of the tonsil is a very discouraging problem, due to the vascular location of the growth and the early metastasis to the cervical glands. If surgical removal is possible, it is probably best done by the method of Von Langenbeck. Radium and the Röntgen rays should always be used in conjunction with surgery.

(m) SARCOMA OF THE TONSIL.

When seen early enough operation is indicated. The method of removal is the same as for carcinoma. In sarcoma the use of Coley's fluid is indicated. This is especially so if it is inoperable. Radium and x-ray should be tried in conjunction with Coley's fluid. At the present time I have

a patient who was treated in the Pennsylvania Hospital with Coley's fluid and radium for a round cell sarcoma of the tonsil. It has been over a year and a half since the last radium application and thus far there has been no recurrence. This case was inoperable from the start. Unfortunately the vast majority of cases respond very little to treatment, and opiates and other palliative measures must be adopted.

v. Diseases of the Pharynx.

(a) ACUTE CATARRHAL PHARYNGITIS.

This condition is frequently associated with digestive disturbances, tonsillitis, acute colds and the rheumatic diathesis. Its prophylactic treatment is naturally directed toward the removal of the causal factor.

The active treatment should begin with the use of calomel or blue mass, followed by citrate of magnesia or Epsom salts.

Salol and acetylsalicylic acid in 0.3 gram (5 grains) doses every three hours are two very useful drugs at the onset. A gargle of warm *liquor antisepticus alkalinus* diluted with water will frequently relieve the dry, harsh sensation in the pharynx. Should there be an associated "raspy" cough or pain in the pharynx, or both, an ice-cap applied externally will do much to relieve these symptoms. A mixture of syrup of ipecac, paregoric and liquor potassium citrate will often produce good results at the onset. A mixture of Dover's powder, 0.06 gram (1 grain), and sulphurated antimony (Kermes mineral), 0.01 gram ($\frac{1}{6}$ grain), dusted upon the pharyngeal wall every two hours will give much relief to a majority of sufferers. No water should be used since the local as well as constitutional effects are desirable. Plain white vaseline in the nose and allowed to trickle down to the pharynx or vaseline taken into the mouth and swallowed will do much to relieve the unpleasant irritation. A twenty per cent. glycerine and water solution of argyrol painted on the pharynx several times a day is most beneficial. Lozenges containing guaiac, camphor or menthol afford relief and stimulate secretion. When the cough cannot be controlled by these measures, heroin or codeine should be used, particularly if it is keeping the patient awake at night. The croup powder, mentioned above, is a most excellent preparation to relieve cough.

(b) CHRONIC CATARRHAL PHARYNGITIS.

An examination of the nose and throat should be made to determine whether they are the sites of the causative factor. If there are diseased tonsils, irregularities of the nasal septum, nasal polypi, or disease of the accessory sinuses these processes must be corrected before any definite relief can be assured. Smoking should be restricted, and also the use of alcoholic liquors; as both tend to maintain irritation. Rest of the vocal organs should be insisted upon whenever possible for public speakers and those required to use their voices a great deal.

The nose should be cleansed with some mild alkaline antiseptic solution night and morning. Probably this can be best done by dropping the solution into each nostril from an ordinary medicine dropper, permitting it to trickle down over the pharynx. This method is preferable to the use of a nasal douche or other similar means where force is used, with the danger that the solution enters the Eustachian tubes and thereby infects the middle ear. The patient should be advised not to blow his nose immediately after cleansing it. When he does clean his nose, the mouth should remain open to prevent the solution from entering the Eustachian tubes. Argyrol in 20 per cent. solution painted on the pharynx or dropped in the nose is a valuable agent.

If the lymphatic nodules in the pharynx are enlarged they should be touched with a 10 per cent. solution of silver nitrate; or after anæsthetization with a 5 per cent. solution of procaine, they may be cauterized with an electric cautery.

A gargle of *liquor antisepticus alkalinus* should be used twice a day. If there is an underlying rheumatic or gouty diathesis it should be treated by appropriate measures. In many cases the uvula is elongated, and should be treated by shrinking it with silver nitrate or by the surgical removal of the elongated portion.

(c) RETROPHARYNGEAL ABSCESS.

The treatment is purely surgical. The pus may be evacuated by either the *internal* or *external* method. As the external method involves considerable surgical knowledge the reader is referred to a surgical text-book. In the internal method the patient is placed on a table with his head well down so that the pus will not escape into the larynx and cause a bronchopneumonia. Very frequently in children the walls of the abscess cavity are so thin that all that is necessary is to push a curved hæmostat into the abscess, open and withdraw it. In adults it may be necessary to make an incision before inserting the hæmostat. Irrigation of the cavity with boric acid solution, when practicable, may be done. An ice-bag externally will aid in relieving the pain and congestion.

There may be an underlying syphilitic or tuberculous condition, therefore proper measures must be taken for their treatment.

(d) ULCERATION OF THE PHARYNX.

This may be tuberculous, syphilitic, or diphtheritic in origin. Less frequently it is seen in typhoid fever. Ulcers due to syphilis or diphtheria usually respond to the specific treatment for the disease. The ulcer should be cleansed, when it can be reached, with *liquor antisepticus alkalinus*, and painted with argyrol. In tuberculosis and typhoid fever the general treatment is most essential.

(e) LUDWIG'S ANGINA.

The preventive treatment demands the proper care of diseased teeth, tonsils and the usual care of the mouth in the acute infectious fevers. It is

due to a virulent streptococcic infection of the cellular tissues of the neck and pharynx.

In the early stages ichthyol ointment and an ice-bag should be applied locally. The old-fashioned flaxseed poultice is of value and is by far the best method of applying moist heat. As soon as the diagnosis is made, free incision is imperative. In most instances no free pus will be found, simply a serous indurated tissue. After the incision has been made, dichloramin-T may be instilled into the wound, but in the writer's experience nothing has been as effectual as the use of the hot flaxseed poultice applied over a single layer of gauze laid upon the wound. These poultices should be large and changed frequently.

This is a most severe and virulent infection, therefore supportive treatment is absolutely necessary. Whiskey in milk punch is of value. It should be given two or three times a day. Strychnine sulphate, for its stimulating and tonic effects, is also useful. Digitalis will be found to be of service when the cardiovascular system requires support.

(f) VINCENT'S ANGINA.

The painstaking clinician believes that this infectious process is much more prevalent than has been supposed heretofore. If a more general recourse is had to bacterial investigation in oral infections this question can be readily solved.

Oral cleanliness is paramount in the prophylactic treatment. When the teeth are diseased, dental advice is indispensable. Those suffering from Vincent's angina should have separate eating utensils, thus protecting the nurse and other persons who come into personal contact with the patient.

When the process has once developed, the daily application of a five per cent. solution of sulphate of copper is a most satisfactory remedy. If deep ulceration occurs, an occasional topical treatment with a five per cent. solution of acid nitrate of mercury yields excellent results. The patient should be given perborate of soda as a mouth wash to be used several times daily. (For further description, see treatment of spirochætosis, this volume.)

vi. Diseases of the Uvula.

(a) OEDEMA OF THE UVULA.

Oedema of the uvula most frequently accompanies acute tonsillitis and peritonsillar abscess; therefore, prompt and efficient treatment of these diseases will frequently prevent its occurrence.

Painting the swollen uvula with a ten per cent. solution of silver nitrate will not infrequently be sufficient. If the oedema is severe and does not respond to the application of silver nitrate, it will be necessary to make multiple punctures with a sharp scalpel. An ice-bag applied externally to the throat, and sucking cracked ice, may lessen the swelling.

(b) ELONGATION OF THE UVULA.

The frequent application of one of the astringent solutions, such as glycerite of tannin or silver nitrate, may prove effectual. More often, however, it will be found more satisfactory to remove a part of the uvula. The uvula is painted with a 10 per cent. solution of cocaine and epinephrin, the tip is grasped with a small tenaculum, and the relaxed portion cut off by a pair of scissors. The tissue should be cut backwards in such a manner that the raw surface is posterior.

(c) TUMORS OF THE UVULA.

Tumors of the uvula both benign and malignant occur. The treatment is similar to that of tumors located elsewhere.

vii. Diseases of the Salivary Glands.**(a) PTYALISM.**

The underlying cause should be sought for in these cases and frequently upon removing it, the condition will gradually improve. Small doses of belladonna and the bromides are the most useful drugs in this condition. (See mercurial stomatitis.)

(b) XEROSTOMIA (DRY MOUTH).

The frequent use of an alkaline mouth wash, the application of glycerine locally and small doses of pilocarpine are useful measures.

(c) PAROTID BUBO (SYMPTOMATIC PAROTITIS).

This complication occurs in the course of one of the acute infectious fevers; pain and swelling require some local treatment as for a similar plight elsewhere. When suppuration occurs, free incision and drainage are in order. Supportive measures, when necessary, should be given.

(d) CHRONIC PAROTITIS.

The proper care of the mouth and teeth are probably the most important items in the treatment of this obstinate condition. Potassium iodide may afford relief.

(e) MIKULICZ'S DISEASE.

The origin is obscure and the treatment is unsatisfactory. Arsenic, potassium iodide and the x-ray are used with varying degrees of success. Disease of the accessory nasal sinuses, when present, should be treated.

viii. Diseases of the Œsophagus.**(a) ACUTE ŒSOPHAGITIS.**

The treatment of mild cases requires no special measures. An ice-bag applied externally and restriction of diet to cold liquids usually suffice.

When severe, deglutition may be so painful that mouth food must be withheld and nutritive enemata given. Small pieces of cracked ice allowed to melt in the mouth may give relief. Opium in some form may be essential when pain is extreme. Supportive treatment is in order.

(b) ULCERATION OF THE ŒSOPHAGUS.

The treatment is most unsatisfactory. If it is possible to reach the ulcer by means of the Œsophagoscope, topical applications may be made. Delimit food by the mouth or stop oral feedings altogether. Rectal alimentation should be given. It may sometimes be necessary to have a gastrostomy performed.

(c) SPASM OF THE ŒSOPHAGUS (ŒSOPHAGISMUS).

This is frequently seen in neurotic patients, but Œsophagismus is sometimes seen in cancer of the Œsophagus or stomach. In neurotic individuals, passage of the Œsophagoscope under a general anæsthetic will not rarely result in a cure. Treatment of the underlying neurosis is essential.

(d) STRICTURE OF THE ŒSOPHAGUS.

The treatment requires dilatation of the constriction by means of the Œsophageal bougie (consult a surgical treatise).

(e) RUPTURE OF THE ŒSOPHAGUS.

This is practically always fatal. The treatment is a surgical one.

(f) DIVERTICULA AND DILATATIONS OF THE ŒSOPHAGUS.

Consult a surgical text-book.

(g) MALIGNANT TUMORS OF THE ŒSOPHAGUS.

The treatment is unfortunately only palliative in a majority of instances. Mouth feedings are advisable as long as the patient is able to swallow—when deglutition, however, becomes too painful, rectal feeding may be used in conjunction with, or completely supplant, oral alimentation. Gastrostomy must be considered when food can not be administered by the mouth. Hanford, in a very able communication says that “by dilatation and the proper application of radium, gastrostomy is avoided, dysphagia relieved, many patients are benefited, life prolonged and a percentage of patients saved.”

The x-ray is to be considered as an additional remedial agent.

Opium, irrespective of its habit-forming characteristics, must be given in sufficient amounts when pain becomes severe.

ix. Anæsthesia in Nose and Throat Surgery.

The choice of an anæsthetic whether local or general must always be determined for each individual by the surgeon. The Report of the committee, appointed at the request of the Council on Pharmacy and Chemistry

of the American Medical Association, to study the advantages and disadvantages of local anæsthesia in nose and throat work, found that local anæsthesia is the method of choice of practically all American rhinologists—there is less hemorrhage, and the dangers of toxicity compare favorably with general anæsthesia. There is far greater safety, especially when operating near the cribriform plate. In throat work, a minority still adhere to general anæsthesia for greater rapidity in work, and ease and comfort to the operator, but the majority are entirely content to operate under local anæsthesia. The position to be assumed by the patient is recumbent but this is a moot question. Each patient should have a hypodermic of morphine and atropin preceding the operation, and remain in the hospital.

II. DISEASES OF THE STOMACH AND INTESTINES.

HAROLD BARCLAY.

i. Introduction.

Many recent important additions to our knowledge of the digestive processes have modified the rational treatment of gastro-intestinal disorders. The modern school of physiology has contributed largely toward a better understanding of secretion and motility, while work along the line of the endocrines and vegetative nervous system has thrown new light on many conditions, heretofore regarded as purely of a neurotic nature.

Before entering into the discussion of actual diseased states and their treatment, it might be well to devote a short consideration to the preventive phase of many of these conditions, for every field of medicine should have its prophylactic side, and our knowledge, gained through physiology and hygiene, applies not only in the cure of disease but the maintenance of health.

Training and environment are largely responsible for our mode of living; the pressure and competition of modern life impose ever new burdens on the organism. It would seem, from a perusal of case histories, that ulcer, cancer and degenerative diseases must be on the increase, after making all allowance for a more accurate diagnostic technic.

Time lost and the impairment of earning capacity, from conditions which we have regarded as being largely functional in character, is not inconsiderable. It has never seemed fair that men and women of the "asthenic habitus," a condition recognizable from the time of puberty by the body configuration, should not be cautioned and taught, that they cannot compete on equal terms with their more robust brothers and sisters without in all probability suffering the consequences. If such advice were heeded, many of the "nervous breaks" might be avoided.

It is fair to assume that in all probability the individual who continuously commits dietetic indiscretions either in regard to quantity, quality, improper balancing or through lack of certain essential foods, will sooner or later pay the penalty.

The strong healthy individual can and does violate hygienic rules with apparent immunity, as far as the present is concerned; but it is in this type that in middle life we so frequently encounter gall-bladder disease and changes of a degenerative nature. Nor is health entirely a dietetic problem; as important a rôle as it undoubtedly plays, other mental and bodily requirements must receive a due share of consideration. "All work and no play," etc., is an old adage; perhaps its reverse is sometimes true, as one finds so often in the competitive struggle that there is but little time left for exercise, rest, and relaxation.

Emotional states, such as pain, fear, and anger, lead to overstimulation of the sympathetic system and adrenal exhaustion. Cannon has shown that such emotions have a very definite bearing on digestive processes, tending to a diminution or suppression of the different juices and retardation or cessation of motility.

Correction of many cases of hypochlorhydria and atony is not to be sought through the agency of drugs, but in a search of the underlying psychical process. Neglect of this phase of the problem not infrequently spells failure.

It would appear that Americans at large are prone to overindulgence in eating. Our general social condition is such that few suffer from actual want and the majority can afford to sit down to a well supplied table, the caloric values far exceeding the bodily requirements of a man leading largely a sedentary life. Not only is the total amount excessive, but frequently the general type of diet is unsuitable and improperly balanced in the relative amounts of protein, carbohydrate and fats. Many men are heavy meat eaters, using meat almost alone to the exclusion of vegetables; while again there are others who believe meat to be injurious, turn to the opposite extreme and live entirely on vegetables. Again the chronic dyspeptic often restricts himself to some bizarre diet that is founded on little or no rational basis, and which is often distinctly injurious, serving only in aggravating his trouble.

Those who suffer from chronic indigestion tend gradually to limit their dietary; they experience discomfort after a certain article of food and in consequence it is eliminated. This process continues until the general nutrition is seriously affected. This is particularly true in the visceroptotic patient with depression states of motility.

Not infrequently the monotony of a diet and the uninviting character of the food tend further to the depression of the appetite and eliminate the digestive stimulus, derived through the desire for food, and its consequent excitation of the appetite juice.

Today in discussing diet one does not merely refer to a proper proportion of protein, carbohydrate, fats and inorganic salts, but in addition to certain substances termed vitamins which have been found to be essential to nutrition, growth, and general well being. As yet but little is known of their nature, but there is overwhelming proof at hand bearing on the integral part they play in the general human welfare. The vitamins are not

synthesized or manufactured in the tissues, but the body depends on an extraneous supply which, in ultimate analysis, seems to be derived from plant sources. That nutritional changes occur, due to the lack or deficiency of the vitamins, has now been proved beyond doubt. A dietary deficient in vitamins results in a decided falling off in appetite. The reverse is equally true, the feeding of vitamine-containing products always results in better appetite and nutrition.

As Mendel suggests, "a further understanding of the vitamins may clear up many of the problems of appetite and alimentary well-being."

In seeking a rational treatment in gastro-intestinal disease we must turn to physiology as a fundamental basis. A comprehensive conception of normal secretion and motility, and, the action of the autonomic system in its control of digestive processes, must serve as a ground structure in all therapeutic measures.

ii. Physiology.

The alimentary canal may be said to consist of a long tube with dilatations in places. In this tube the food is subjected to a series of enzymes. The dilated sections are capable of being shut off from the neighboring sections by means of rings of muscle, the sphincters, so that food shall not be passed on to the next section prematurely. As a rule, arrangements exist by which the secretion of the digestive juices in a particular section is brought about by the presence of food in the preceding section, so that no delay in the process occurs. The initial stimulus to the secretion of both saliva and gastric juice is instituted by what Pawlow and his school have styled the psychic or the appetite juice. The investigators found that in a hungry dog, the smell or sight of food excited both a copious flow of saliva and gastric juice, and that this phenomena did not take place after the division of the vagi, proving conclusively that this preliminary stimulus to salivary and gastric secretion was due to a nervous influence.

They moreover showed that the character of the juice poured out varied greatly with the diet that excited it. Thus a meal of bread, caused the secretion of a small amount of juice, rich in pepsin but poor in acid. Meat caused a much larger secretion of a juice weaker in peptic power but containing more acid. Milk required even less pepsin to digest than meat. Under experiment, and unknown to the dog, solid food introduced directly into the stomach through a gastric fistula produced no secretion for an hour or more. In like manner mechanical stimulus of the stomach mucosa will produce no secretion. These latter facts are interesting and instructive, as they show that without the stimulating effects of appetite there occurs a material retardation in the gastric digestion. There is more truth than fiction in the old saw that "hunger is the best sauce."

Gastric digestion then occurs in two stages. The first, as we have just shown, is of nervous origin, excited by the thought or smell of food; the second or chemical begins when absorption has begun. The mechanism of

this second secretion has been shown by Edkins to depend on a chemical factor, which explains the occurrence of digestion after division of the vagi.

Edkins found that gastric secretion once begun, was maintained by certain saurogogues elaborated in the pyloric glands of the stomach. This he proved by injecting an extract of pylorus mucous membrane into the circulation of fasting animals causing the secretion of a juice containing both hydrochloric acid and pepsin; a similar extract of fundus gland producing no effect. This chemical stimulant or hormone, of the pyloric glands has been called gastric secretion, and is the agent by which the continuous secretion of the fundus glands is excited to maintain gastric digestion after the appetite has been assuaged.

Cannon has shown that the action of the pyloric sphincter is in great degree regulated by the presence of free hydrochloric acid in the pyloric end of the stomach. At a certain stage in gastric digestion, after the protein food substances have absorbed and utilized the required amount of acid, the excess liberated serves as a stimulant toward the relaxation of the pylorus, permitting acid chyme to pass into the duodenum.

The acid chyme on reaching the duodenum in its turn, stimulates the contraction of the pyloric sphincter, shutting off any further escape of stomach contents, to permit of intestinal digestion. This, as Cannon points out, is in accordance with the general laws of peristalsis, that dilatation occurs below and contraction above the place of stimulation.

Recent investigation of pyloric control by Luckhard, Phillips and Carlson would lead to the conclusion that certain motor activities of the stomach as well as chemical are intimately associated with the relaxation of the pyloric sphincter. Thus we see that carbohydrate, taken at the beginning of a meal, cannot fix the free hydrochloric acid; consequently the pyloric sphincter relaxes and it passes rapidly from the stomach. This is in adaptation to the fact that carbohydrates cannot be digested by gastric juice, and as soon as the acid has put an end to salivary digestion, no useful purpose is served by their retention in the stomach.

Stomach Movements.—Through the agency of the x-ray a large amount of information has been acquired of gastric motility. The normal stomach fills from above downward, so that there is an appreciable retention of food in the cardiac portion; thence, without the aid of peristalsis, it passes the *angula incisura* into the pyloric half. Here active waves are soon seen sweeping toward the sphincter, occurring about the rate of three times a minute, gaining force as they pass forward. Long after the fundus has returned to its fasting condition, the pyloric portion contains food and shows those vigorous waves of contraction which form the "gastric mill." The semi-digested food is thus kept in close contact with the glands in which the stimulant to gastric secretion is elaborated, thereby providing for its own digestion. With the entrance of the gastric chyme into the duodenum, pancreatic secretion begins.

Von Mering showed that hydrochloric acid introduced into the duodenum, caused a closure of the pylorus, and that it remained contracted

until the acid was neutralized by the pancreatic juice. The same phenomena was observed when hydrochloric acid was introduced further down the intestine until a point was reached about two feet from the cæcal valve when the action ceased.

Bayliss and Starling made the important discovery that hydrochloric acid of the gastric juice coming in contact with the mucous membrane of the small intestine, resulted in the production of a chemical stimulant secretion which, when absorbed into the blood stream, acts as a specific stimulant of the pancreas.

Hydrochloric acid injected directly into the blood stream was ineffective, while, on the other hand, a saline infusion of intestinal mucosa with hydrochloric acid was equally effective in causing pancreatic secretion.

While the main source of pancreatic secretion is undoubtedly chemical, there is evidence that there is a nervous factor as well. The secretions of the liver can be produced by the same acid extracts of duodenum which excite the pancreas.

Small Intestinal Movements.—The first portion of the duodenum, or what is designated radiographically as the cap, has a different function from the remainder. It is there that gastric chyme undergoes neutralization by the pancreatic and biliary secretions.

The movements of the small intestine are of two kinds: *first, pendulum movements*, described by Bayliss and Starling, or segmentation, as described by Cannon. These depend on muscle tone and serve to mix food. *Second, peristaltic movements*, a powerful wave of constriction following immediately a wave of dilatation so that the contents are drawn forward from a contracted into a dilated area. These movement waves are stimulated from within the bowel by the plexus of Auerbach; from without the bowel, through the autonomic system, the vagus increasing and the sympathetic sphincter inhibiting them, with this exception, that the splanchnic nerves supply motor fibres to various sphincters.

In certain instances the extrinsic (autonomic) interferes with normal intrinsic (Auerbach) producing inhibition. This is seen especially after operations, where the manipulation of stomach and intestine leads to an arrest of peristalsis.

Cannon's work has shown that delay never takes place in the small intestine, save in cases where actual mechanical obstruction exists, or for short periods following operation. He also called attention to the ability of the peristaltic rush to force the intestinal contents past sharp bends or kinks. This latter observation is one of some interest in relation to the theories of Lane.

Of the three different classes of foodstuffs carbohydrates pass through the small intestine with the greatest rapidity due in part to their high percentages of cellulose.

The ileo-cæcal sphincter prevents the too rapid passage of food contents from the small into the large intestine, allowing additional time for further digestion and absorption in the small intestine. Ileal stasis is thus a normal physiological condition (Hurst).

Some observers, among them Elliott, believe that the ileo-cæcal sphincter also serves the purpose of preventing regurgitation of food back into the ileum. Case found regurgitation at the ileo-cæcal sphincter in one-sixth of 1500 cases examined.

Movements of the Large Intestine.—The passage of food through the large bowel is at a much slower rate than that observed in the small intestine, and permits absorption of water, the contents becoming more solid.

From the functional standpoint the large bowel can be divided into three portions, and these do not correspond to anatomical divisions. The first, a proximal part, is characterized by the presence of antiperistaltic waves. Anatomically this roughly includes the colon to a point midway in the transverse colon. These to and fro movements permit an additional time for absorption. Second, an intermediate portion, conforming to the type of movement seen in the small intestine; and third, a distal portion—the rectum—where the central nervous system again assumes control. It is in this last portion—the rectum, that the automatic call for discharge can voluntarily be suppressed. According to Hurst, the entire large intestine below the splenic flexure is normally evacuated at a single act of defecation.

Defecation.—Approximately nine hours after ingestion material enters the descending colon and remains there until the next action of the bowels. This means, as Hurst has pointed out, that when the bowels are opened once per day, the interval between a meal and the excretion of its residue will vary between nine and thirty-three hours. With the distention of the pelvic colon it rises in the abdomen this rendering the angle with the rectum less acute, and thus facilitating the downward passage. The rectum is normally empty, except during the act of defecation. The distention of the rectum creates the desire to defecate—this distention may be increased voluntarily by contraction of the abdominal muscles. The discharge of fæces is further facilitated by the recto-coccygeus muscle which draws the rectum backward and straightens out the angle of its lower portion, while the anal sphincters are released. The levator ani muscle acts mainly as a voluntary sphincter, and helps direct fæces forward toward the entrance of the anal canal, drawing this canal upward over the faecal mass, and finally contracting firmly behind it.

Nervous Control.—The dominant nervous agent of the digestive system is the para-sympathetic, both on the secretory and motor sides. An outstanding fact is the manner in which the vagus controls the digestive processes, right down to the point at which the sacral division of the para-sympathetic takes charge. The para-sympathetic and sympathetic are antagonistic in their action throughout the alimentary tract.

The *para-sympathetic* produces those sensations of hunger which lead to the taking of food. It starts and to some extent maintains the secretion of the active chemical juices that digest the food. However, although the para-sympathetic imitates digestive secretions as food passes along the alimentary canal the nervous factors become less important and the chemical factors more important.

Corresponding to this we find that the antagonistic action of the sympathetic is more clearly demonstrable in the inhibition of salivary secretion than of gastric or pancreatic. There can be little doubt that the sympathetic has an inhibitory action on gastric secretion. Cannon clearly showed this by the cessation of secretion in frightened or enraged animals.

On turning to the mechanical factors, we see that from the moment the food bolus passes between the pillars of the fauces, to the time its residue reaches the rectum, it has escaped from the control of the voluntary nervous system and is directed by the autonomic nerves. We may regard this involuntary part of its course as divisible into three main districts (1) the pharynx, œsophagus and cardiac half of the stomach, where both motor and inhibitory nerves are supplied by the vagus (division of para-sympathetic); (2) the pyloric half of the stomach and the small intestine, supplied with motor fibres by the vagus and inhibitory nerves by the sympathetic through the solar plexus, (3) the colon and rectum, supplied with motor fibres by the pelvic visceral nerve (sacral division of the para-sympathetic), and inhibitory nerves by the sympathetic through the inferior mesenteric ganglion.

iii. Diseases of the Stomach.

(a) ACUTE GASTRITIS.

Acute gastritis is most commonly due to dietetic errors, but the cause may be the inflammation which accompanies the acute infectious diseases, or ingestion of the irritant poisons or of tainted foods. Rarely, an acute suppuration of the stomach is met with, a phlegmonous gastritis, the treatment of which belongs to the surgeon.

The Treatment.—The first consideration is to remove the poison, and this is best done by lavage, using from 3 to 6 liters (quarts) of warm water and continuing the procedure until the water returns clear. In the same manner the bowels can be moved by enemata or irrigation. In very severe cases, especially after certain forms of drug poisoning, general supportive measures may be required such as stimulation by strychnine or caffeine.

All food should be withheld until the acute stages have passed, when bland substances, such as albumen water, barley gruel, and arrowroot may be used.

Cracked ice should be given to control thirst, or if excessive, and the nausea and vomiting are severe, plain water, 200 to 300 cc. (6 to 8 ounces), can be given by rectum every four to six hours. Where a stimulating effect is desired, coffee may be added, or if nourishment be necessary, 5 per cent. glucose solution substituted for the water by rectum.

(b) CHRONIC GASTRITIS.

Two types may be distinguished.

Primary—due to overindulgence in food or where the food is of an unsuitable character, insufficiently masticated from rapid eating or lack of teeth; the excessive use of alcohol, or tobacco; local infections resulting

in the swallowing of pathogenic organisms, and excessive use of purgatives.

Secondary, either an extension of an acute gastritis or complicating carcinoma, ulcer and atony, or from conditions giving rise to venous stasis in disease of heart, lungs, liver, portal vein and kidneys. In fact, secondary chronic gastritis, is associated with a large number of constitutional conditions such as chlorosis, pernicious anæmia, leukæmia, syphilis, and diabetes mellitus.

Treatment.—The first step should be directed to the treatment of any focal infection. The condition of the teeth should permit of adequate mastication, and the mouth be kept clean by appropriate mouth hygiene.

The diet must be adequate to maintain a normal degree of nutrition. Foods containing an excess of cellular residue and hard substances are to be avoided. The use of tobacco is to be regulated, as well as the avoidance of iced drinks.

LAVAGE.—For the direct treatment of the gastric mucosa, lavage of the stomach is most effective. Lavage is indicated when there is an excess of mucus, fermentation, or disturbed motility. It is done in the following manner: A Rehfuß tube is swallowed, either before breakfast, or at a time when the stomach is practically empty—ordinarily three or four hours after meals. The stomach is then washed with a solution of sodium bicarbonate, 30 grams (1 ounce) to a liter (quart) of warm water, until all food detritus and mucus has been removed. This usually requires two to three liters of water. Following this the stomach may be directly medicated by introducing a liter (quart) of 1-5,000 silver nitrate or potassium permanganate solution. The patient should be permitted to lie down for a minute, turning first on the right and then on the left side; then the solution must be carefully aspirated, care being taken to ensure its complete removal. The stomach should then be lavaged with a liter of plain water. Lavage should be practised two or three times per week for a period of several weeks, until practically all traces of mucus have disappeared; then it may be done once a week or once in ten days until one is assured there is no recurrence of the condition.

The bowels should be regulated as far as possible by diet. Purgatives are to be avoided. A glass of water before breakfast and between meals is of benefit. Purée of fruits, honey and milk sugar, or mineral oil by mouth will usually suffice. In more stubborn cases an enema or irrigation will be of benefit. Diarrhœa can frequently be controlled by relieving the bowel of putrefactive material; to this end it may be advisable to begin treatment by administering a dose of castor oil.

Mild gymnastics are of benefit in building up the general body tone. The principal meals should be followed by short periods of rest. Where chronic gastritis complicates, secondary to passive congestion or a constitutional disease, the main effort is to be directed to the primary affection. In such conditions the gastritis assumes secondary proportions. In many cardio-nephritic conditions the advisability of passing a stomach tube is questionable.

(c) ATROPHIC GASTRITIS.

Atrophic gastritis—or as Bassler prefers to call it, “gastric cell primary atrophy” may be divided into:

- (1) Cases in which it is normal and does not produce symptoms.
- (2) Psychologic cases.
- (3) Reduced state of general body health, from fevers or senility.
- (4) Endocrine or hormone disturbance.
- (5) Pathological states of the stomach glands, leading to loss of secreting function of the gastric cells.

The functional cases have been considered in the chapter on gastric neuroses.

Here we are concerned with the fifth subdivision, *viz.*, atrophic gastritis. Much that has been said previously applies here.

Atrophic gastritis is associated with pernicious anæmia, and the gastric symptoms may be one of the early manifestations of the disease.

Treatment.—The principal therapeutic indication is to relieve the stomach from all unnecessary work, and at the same time to lighten the load on an overworked intestine. Little good is accomplished by closely restricted “pap” diets. These patients do infinitely better on normal food that has been well cooked and thoroughly masticated. Lean meats should be tender and cut fine so as to make the least possible demand on the stomach and intestines. The same applies to vegetables and fruits, which should be passed through a purée sieve to remove the coarser cellular residue. Milk, as a rule, is poorly borne in depressive gastric secretory disorders. Beef, owing to its coarse fibre, is not suitable. It offers difficulties to a thorough impregnation by intestinal juice. If it is used at all, it is best finely chopped or scraped.

The diet further must be such as to permit of gain in weight, as many dyspeptics suffer from undernutrition, due to closely restricted diets. Fats in the form of cream and butter are well borne and are of value in maintaining nutrition.

I regard it as undesirable to measure diets. Making caloric determinations, the dyspeptic is too prone to become introspective, and such an attempt at accuracy is unnecessary, and only tends to rivet the mind of the individual on his condition.

The first indication is to put as little food in the stomach and intestine as possible at the same time improving the general nutritional state. In other words, a full normal diet, with such modification in character as has just been referred to. If there is a disturbed mobility, meals should be small and at more frequent intervals, so as not to overdistend the stomach.

Along the lines of general building up, attention should be directed to lessening mental anxieties and worries.

A sojourn in the country is always of benefit with normal recreation in the form of sports, provided they are not carried to excess. Sufficient unin-

interrupted sleep is a necessity. Rest after meals is of real benefit, for in certain limits it lessens the "gastric rush" which occurs in achylia.

For the troublesome diarrhoea the chief indication is to rid the bowel of irritation products. To accomplish this small doses of castor oil 0.6 to 2 cc. (10 to 30 minims) in capsules, or mineral oil 30 to 60 cc. (1 to 2 ounces), should be used. High colonic irrigations or enemata are of service.

Drugs.—Although drugs play a secondary part, the chief measure being diet and hygiene, hydrochloric acid is a valuable adjunct in the treatment. Bic reports a case of achylia gastrica in which he used hydrochloric acid in large doses, one cc. (15 minims) of the dilute acid in 250 cc. (8 ounces) of water, once a day, increasing it gradually to 5 cc. (1½ drams) in 250 cc. of water and continuing this dose at intervals for nearly three months. It was administered through a small stomach tube. The results were very satisfactory, both in the digestion and anæmia. In the Bic case the hydrochloric acid was not given daily, but nine times the first month, six the second month. He raised the dose finally to 8 cc. (2 drams) in 500 cc. (1 pint) of water, thus approximating normal amounts. The acid was given fasting. Dilute hydrochloric acid is usually given in 0.6 to 1.2 cc. (10 to 20 minims) doses diluted with water and sipped with meals. It may be repeated in one half hour.

It sometimes happens that hydrochloric acid is not well borne, causing distress and burning in the throat. The alternate choice is pancreatin. Pancreatin is administered with sodium bicarbonate with the object of bringing about gastric digestion. The dose is 0.3 to 1 gram (5-15 grains) given with an equal amount of bicarbonate of soda after the principal meals.

Where the appetite is poor, the bitter tonics are often effective in stimulating it, probably by a purely local action on the taste buds of the mouth. The simple bitters as gentian, cinchona, condurango and calumba are prescribed as tinctures in twenty drop doses diluted in water and administered before meals.

In the more severe cases of achylia, with cachexia and severe diarrhoea rest in bed is of benefit.

In a small number of cases I had autogenous vaccines prepared from organisms found in the stomach. These were administered, but the results were disappointing.

(d) TREATMENT OF GASTRIC AND DUODENAL ULCER.

There is not, strictly speaking, any specific treatment for ulcer. The natural tendency of tissue is toward repair. Our efforts must lend themselves to help Nature's processes and to eliminate any interference.

Ulcer has been produced experimentally by many different means, but whatever the method employed, the physical characteristic of the lesions have been similar, so that the etiology still remains obscure. Rosenow has revived the theory of infection, and by the injection of streptococci, obtained from mouth and throat has succeeded in producing acute and chronic ulcer.

Bolton, by injection of a sterile emulsion of gastric mucosa or of the

mucous membrane of appendix or gall-bladder, produced necrosis and ulceration in the organ from which the original cell emulsion was made. His experiments suggest that many constitutional states result in a disintegration of body cells, which elaborate poisons of a specific nature with respect to the tissue from which they are derived.

That vagotonia, with its attendant secretory and motor disturbance, plays an etiological part, has much evidence to support it. I have but vaguely touched on the possible etiology of ulcer to show that a narrow conception is impossible. It is probable that the cause of ulcer varies and is highly individual. It would seem as if the "corrosion theory" in the light of modern research was no longer tenable. The study of gastric secretions has shown that acid values are obtainable in health as high or higher than those found in frank gastric ulcerations; also acid, both organic and inorganic, has been introduced into the stomach in five-fold the normal strength without producing ulcer pain or pyrosis.

Treatment.—There have been many methods advocated for the treatment of ulcer, but they all have the same fundamental principles, *viz*—to obtain physiological rest for the part, by methods of feeding so adapted as to produce the least demands on the secretory or motor functions of the stomach. Drugs are adjuncts in the treatment and are utilized to neutralize or control secretions and to relieve spasm contractions. There is no specific remedy, nor can there be until we know the cause of ulcer.

Before treatment may be discussed, it is necessary to first decide what type of ulcer is suitable for medical treatment and what type should be turned over to the surgeon.

Surgical Ulcer.—

1. Acute perforation demands immediate surgery. If, however, a period of forty-eight hours has elapsed and there is no evidence of peritonitis, it is often best to delay operation until the perforation has been well walled-off.

2. Ulcers, other than luetic, producing great gastric deformity, offer little hope for permanent relief by medical measures.

3. Large callous ulcers, with persistent bleeding or recurring attacks of bleeding, should be operated upon.

4. Indurated ulcers, especially when there is pyloric stenosis, or evidence of adhesions, should be treated surgically.

5. When there is any suspicion of malignancy.

6. Patients who have had at least two carefully conducted ulcer cures, and who have persistence of symptoms.

7. Penetrating ulcers and hour-glass contractions.

To this list may be added certain cases that are complicated with severe neurasthenia, and in which the prolonged treatment works detriment to the general health, or those who are in danger of contracting an anodyne habit.

With the exclusion of the above group, uncomplicated ulcer belongs to the domain of the internist.

Focal Infection.—As a preliminary measure to treatment, a careful search must be made for focal infections, and their elimination as far as possible. This applies especially to the teeth, and tonsils, but intra-abdominal infections of the fallopian tubes, appendix and gall-bladder should not be ignored.

Rest.—While some ulcers undoubtedly heal more rapidly than others, experience has taught that on an average we must allow at least four weeks for the cure, the first three weeks being spent absolutely in bed, eliminating as far as possible all mental excitement. Friends should be excluded and the transaction of business prohibited. Reading may be permitted, but should be of a light character. All mental excitement increases gastric peristalsis. Where possible there is a great advantage in a hospital or a sanatorium. Aside from the better nursing facilities these afford, the change from the home environment has a decided salutary moral effect and makes the general control much easier.

The Management of the Case.—The patient is put in bed, and moist heat applied to the abdomen. This may be done with the so-called Preissnitz compress, *viz.*, a piece of flannel or spongo-pilene, wrung out in water, applied to the abdomen and covered with a folded towel to maintain warmth. A covering of oiled silk prevents seepage of water, and the whole arrangement is held in place by an abdominal binder. An electrotherm may be applied over a piece of moist flannel. Care must be taken to prevent moisture from soaking into the electrotherm and short-circuiting it, by interposing two thicknesses of rubber tissue. The electrotherm is held in place by an abdominal binder.

If there is any evidence of bleeding, an ice-bag should be used instead of heat. The patient should be bathed in bed for at least the first two weeks, longer if there has been any recent hemorrhage.

For the initial three to five days all food and water by mouth are withheld. Fluid in the form of a normal saline solution is supplied by the rectal route by means of the Murphy drip. A five per cent. glucose solution has the advantage of checking acidosis. At least three pints of saline should be given in the twenty-four hours.

Particular care must be directed to the hygiene of the mouth. By allowing the patient to suck a bismuth lozenge at intervals during the day, the salivary glands are kept active, thus diminishing the chance of parotitis, which is due to an ascending infection of the salivary ducts. The bismuth further tends to neutralize gastric acidity and forms a protective coating over the ulcer. The mouth should be rinsed at frequent intervals with a mild antiseptic wash, the best being a weak solution of potassium permanganate in plain warm water. Glycerine mouth washes, owing to the amount of dessication which follows their use, are contraindicated. Ice is also objectionable, although pleasant at the time, as it aggravates thirst.

In poorly nourished anæmic patients it is best to terminate the fast at the end of seventy-two hours. In well nourished subjects, or where there has been recent bleeding it is advisable to rest the stomach for a full one

hundred and twenty hours (5 days). At the end of the fasting period, mouth feedings are begun. These consist of 60 cc. (2 ounces) of peptonized milk given every two hours from 8 A. M. to 8 P. M. The same amount of water or Vichy Celestin is given on the alternate hours. No nourishment is given during the night save small quantities of water if desired. The amount of food is gradually increased by the addition of small amounts of cream in the proportion of $\frac{1}{4}$ cream to $\frac{3}{4}$ milk. By the fifth day 60 cc. (2 ounces) of peptonized milk with 15 cc. ($\frac{1}{2}$ ounce) of cream is allowed at each feeding, while the water is increased in the same proportion. With the larger intake of fluids by mouth, the Murphy drip may gradually be reduced.

The diet is thus slowly built up so that after the fifth day of feeding, if all symptoms have subsided, the milk is more rapidly increased. On the sixth day one raw egg is added, beaten up in the milk. These are increased one per day until three eggs are consumed each day, and this amount of food is continued to the tenth day.

MILK.—Junket or a baked custard can be substituted for one or two milk feedings. Later a medium portion of strained oatmeal, farina, or cream of wheat is given in place of the milk for the 8 A. M. feeding. The addition of cream and sugar is permissible.

From the 10th to the 14th day the diet can be brought up to a scheme somewhat as follows:

8 A. M. Heaping tablespoonful of cream of wheat, wheaten, or farina, well cooked and served with cream, and powdered sugar.

10 A. M. 120 cc. (4 ounces) peptonized milk to which 15 cc. ($\frac{1}{2}$ ounce) of cream is added.

12 A. M. One slice of cream toast of medium thickness, or medium baked potato with unsalted butter.

2 P. M. Peptonized milk and cream as at 10 A. M.

4 P. M. One cup custard, baked.

6 P. M. Junket or two heaping tablespoonfuls of well steamed rice or cereal, as in the morning, served with butter or cream or both, and which may be sweetened with powdered sugar.

8 P. M. Peptonized milk and cream.

15th to 20th day.

8 A. M. Cereal with cream. One slice crisp toast, one poached or boiled egg without salt or pepper, one glass plain milk.

10.30 A. M. Junket or baked custard.

1 P. M. Fish, plain boiled with egg and cream sauce. Halibut, bass, fresh cod or breast of broiled chicken.

Baked or mashed potato or macaroni, cooked with cream sauce. No cheese or tomatoes.

3.30 P. M. Junket or custard or glass of plain milk.

6.30 P. M. One egg; plain boiled or poached; two slices crisp or creamed toast; cereals as at breakfast.

21st day.

8 A. M. Breakfast: Cereal and egg and milk.

10.30 A. M. Junket or custard or milk.

1 P. M. Fish, chicken, squab or medium portion scraped beef; baked or mashed potato, or rice, or macaroni. Choice of two vegetables, one green one starch, such as purée of spinach or carrots or peas. One slice of toast, unsalted butter. Medium portion rice, tapioca or sago pudding, or prune soufflé, or charlotte russe.

4.30 as at 10.30.

7 P. M. Cream soup made without meat stock, as cream of potato, rice or cauliflower, purée of split peas or beans; 2 eggs, toast, pudding as at lunch.

Beginning with the fifth week the diet is practically the same with a few slight modifications as that during the fourth week, a cup of Postum or cocoa such as Epp's or Baker's breakfast cocoa, made with half water and half milk, may be added to the breakfast. The portions at 10.30 and 4 o'clock may be moderately curtailed. The luncheon is practically the same. At the evening meal a small portion of meat and vegetable is added as at lunch time.

Constipation is the rule during the early periods of treatment. This is controlled with mild salines, such as sodium sulphate or small doses of Carlsbad salts. Every other day, if necessary, an enema is given.

After the first week the relief of symptoms is very striking. After ten days or two weeks of treatment if the symptoms do not entirely subside, it is advisable to make a reexamination of the patient with the view of determining whether the condition is not other than ulcer.

Rectal Feeding.—Little can be expected from rectal feeding other than the absorption of the fluids and a limited amount of carbohydrate. It is quite impossible to maintain nutrition by means of the rectum. If we are to have any success with rectal feeding it is necessary that food be given in fluid form. The digestive power of the colon is very slight. It is improbable that albumin can be absorbed to any extent; this is likewise true of fats. Even when albumins have been completely pancreatinized absorption is limited. It has been claimed that large nutrient enemas will pass the ileo-cæcal valve where absorption is physiological. Experiments have been made with charcoal particles given in a soap and water enema, the particles being found in the stomach, but it is questionable if this can be relied upon as a regular event. Normally carbohydrates are absorbed by the bowel as dextrose, and of all the foodstuffs this seems to be the best utilized in rectal alimentation. Dextrose may be given in a 6 to 10 per cent. solution, 240 to 300 cc. (8 to 10 ounces) of fluid being injected directly into the rectum, or allowed to flow slowly by means of the Murphy drip.

Whatever advantage there may be in rectal alimentation, is probably due to the salts and the water which are freely absorbed by the large bowel.

Persistent vomiting is an occasional complication in rectal feeding, and when it once begins it is apt to persist until mouth feeding is resumed. It is probably caused by the acidosis consequent to starvation. The pronounced sub-nutrition produced by rectal feeding is unfavorable to the heal-

ing of an ulcer, and this is especially true if the patient is in poor physical condition at the onset.

During the first two weeks the patient is kept absolutely in bed. At the end of that time he may be allowed to get up and use the commode once a day. It has been my custom not to allow them their full toilet privileges until the 18th or 21st day. It is well to avoid the psychic stimulation of gastric juice by preventing the appetizing aromas from the kitchen penetrating to the sick room, the sight of fancy trays, etc.

The After Treatment.—The treatment of the second month. At the termination of the four weeks the patient is gotten out of bed at first for half an hour in the morning and the same time in the afternoon. This period is gradually expanded so that towards the end of the fifth week the patient may be allowed to take a drive, and after that short walks. Care should be taken especially when the patients return to their homes to caution them against assuming the regular routine of life too quickly. This point would seem to have some importance, for many patients regard the treatment as being terminated at the time they leave their beds; they must emphatically understand that this is not so, that their treatment should continue at least during the second month.

THE CONTROL OF ACIDITY.—In those individuals who have shown a high gastric curve it has been my practice to give an alkali one-half hour following each feeding such as sodium bicarbonate or calcined magnesia. These may be given in doses of 1.2 to 2 grams (20 to 30 grains). If pylorospasm or intestinal spasm is present, especially at the beginning of the treatment, it may be controlled by the use of atropin. A convenient way to administer this drug is to dissolve 0.0006 gram ($\frac{1}{100}$ grain) in a glass of water and allow the patient to sip this during the day. It is frequently possible to increase this to 0.003 gram ($\frac{1}{20}$ grain) during the day.

Later Diet.—In prescribing the final diet one should avoid such foods as remain a long time in the stomach and thus excite a prolonged flow of gastric juice, such as fat meats, ham, pork, beef, game; furthermore, eliminate all such foods as are known to stimulate gastric juice, the most important among these being meat extracts, clear gravies, alcohol, spices and an excess of salt.

Hemorrhage.—Small traces of occult blood, especially at the beginning of the cure, should be carefully watched. They do not call for any particular treatment, as usually in a day or so the condition clears up. Where occult blood persists for a period of two or three days, or if the patient shows a definite secondary anæmia, special treatment is called for; or where hemorrhage has existed just previous to the beginning of treatment it is well to prolong the fasting time up to five or even more days—the condition of the patient will govern this prolongation to some extent.

If the general condition of the patient permits, it is well not to advance the diet too rapidly. Persistent recurring hemorrhage calls for surgical intervention. The presence of a frank hemorrhage where the patient vomits calls for the absolute withholding of food by mouth, the

application of an ice-cap to the epigastrium and the hypodermic injection of morphine.

Medical cures should follow surgical procedures for gastric and duodenal ulcer. Gastroenterostomy does not remove the ulcer; it simply diminishes the gastric acidity and allows the stomach to empty with the minimum irritation at the ulcer site. Surgeons are beginning to realize more and more the advisability of following up their gastroenterostomies with definite ulcer cures. It must be remembered that the disappearance of symptoms does not mean a cure, and since ulcer is a disease of periodic remissions and exacerbations, the postoperative diet should be planned along the lines indicated in the medical treatment for ulcers.

Drugs.—There is no medication that has any direct bearing on the healing process of the ulcers. The alkalies such as sodium bicarbonate and magnesium hydroxide are indicated if the gastric analysis shows a high acid curve. Belladonna relieves the pains of pylorospasm.

(c) CANCER OF THE STOMACH.

Of all carcinomata of the body, forty to forty-five per cent. develop in the stomach, and of these sixty per cent. are located in the pyloric portion of the viscus. Several types of cancer are met with and in order of frequency they are medullary carcinoma, adenocarcinoma, colloid carcinoma, and scirrhus carcinoma. Medullary carcinoma is the most malignant and rapidly progressive, tending to early metastasis, ulceration and hemorrhage. Adenocarcinoma appears at times to be the result of carcinomatous degeneration of adenomatous polyps. Colloid carcinoma shows more frequent growth by extension and greater infiltration than the medullary forms. Scirrhus carcinoma is more slowly progressive and ulceration is a late development. It frequently begins in the pyloric region, ultimately extending through the body of the stomach and producing, at times, the condition known as *limitis plastica*. Because of its frequent onset in the pyloric region early symptoms are the rule.

Treatment.—The treatment of malignant growths of the stomach belongs to the domain of the surgeon; upon the physician resting largely the responsibility of determining the question of operability. The latter is a difficult problem, and often the final decision can be made only after an exploratory laparotomy. Many growths cause few or vague symptoms until they have reached a stage of development that precludes any possibility of operative relief to say nothing of a cure. The most successful cases from the standpoint of surgery are growths involving the pyloric portion of the stomach, owing to the fact that they cause early and more definite symptoms from blocking the outlet of the stomach, thus leading patients to seek advice earlier than they might otherwise do. A pylorectomy in many of these early cases enables one to make a comparatively sanguine prognosis, covering a limited number of years. I have two such cases, under observation now of four and a half and three and a half years standing.

Extensive growths involving the pylorus, or the body of the stomach, that preclude excision, may demand a gastroenterostomy to afford temporary relief. It has been my experience, however, that such patients do not long survive the operation, as the tumor mass develops rapidly following the mechanical manipulation by traumatic extension.

In growths involving the body of the stomach, surgery offers but little promise of a cure unless one is fortunate enough to make an early diagnosis.

Internal Treatment.—Today we know of no remedial measure that cures cancer of the stomach. No satisfactory results have materialized from radium, x-ray, or metals in colloidal form. Our treatment is directed to the alleviation of symptoms that arise in the course of the disease.

Diet.—The most important feature of treatment is diet. While there are some patients who experience comparatively little discomfort, and in whom the appetite and secretions are but slightly interfered with, particularly with the carcinomata of the body of the stomach, there are others in whom loss of appetite, or what is literally repugnance for food, is an early manifestation and makes feeding difficult. Not only is there marked anorexia, but the patients dread the discomfort which follows the ingestion of a meal. As a rule, the state of the gastric secretions and motility will influence the character of the diet.

Where the stomach secretions show a normal or hyperacidity and motility is well maintained, in the absence of any obstruction in the pylorus, it is possible to prescribe a fairly generous and varied dietary. Here we may order tender lean meats, finely divided vegetables served as purées, the cereal puddings, cooked fruits, as purée, cream of pot cheese, junkets, and baked custards. There is frequently a desire for piquant food, such as pickles, anchovy, or dishes that have a distinct flavor, and such articles may be tried as they often serve to stimulate the appetite.

Fluids are best given between meals when possible. Beverages that have a high nutritional value should be utilized, such as milk and cocoa. To assuage thirst, water or grape or loganberry juice can be used. Aerated drinks may cause gastric distress and are best avoided.

If there is much distress, it is frequently more advantageous to give small feedings repeated at short intervals.

Where the gastric secretions show a low or an acidity it is generally necessary to reduce or withdraw animal protein.

In prescribing a diet it is well, as far as possible, to gratify the desires and tastes of the patient. The manner in which food is prepared and served adds much to the relish.

In motor insufficiency, due to pyloric stenosis, the maintenance of nutrition becomes much more difficult. Here it will be necessary to reduce food to a consistency that will make the least demands upon the gastric musculature, and allow it to pass the diminished lumen of the pylorus. The food should be liquid or semi-solid. Fats and proteins can be used so long as free hydrochloric acid is present in the gastric juice. The feedings should not be larger than necessary; it is often better to feed less at a time at

more frequent intervals (2 to 3 hours). Such articles as cream soups, broth, well cooked meats finely divided, small portions of baked toast or rusk well masticated may be used. Carbohydrates in excess are not well tolerated. Green vegetables even as purée are not advisable. The addition of milk and cocoa is of service both from the beverage and nutritional standpoint. Junkets, baked custards, pot cheese, cream, butter and olive oil, should be used as much as possible.

Artificial protein preparations are helpful, such as somatose and tropon. The former contains 90 per cent. albumoses. The action is largely tonic, being a stimulant to appetite and secretion. The dose is 3 to 4 dessert-spoonfuls a day. It is not well borne in hyperacidity. Tropon is prepared from animal and vegetable protein insoluble in water, but can be given in milk, bouillon, cocoa or soup. It contains 90 per cent. and over of protein.

Paul Colanheim, when I worked in his clinic, was successful in maintaining nutrition in inoperable carcinomata by the free use of olive oil. It was prescribed 3 to 4 times daily, warmed to body temperatures and given before meals in 30 to 60 cc. (1 to 2 ounce) doses. I have tried it in this country without much success as it causes either nausea or anorexia. However, it is worthy of a trial. If the stomach is being lavaged the oil can be introduced through the tube. This is desirable when the taste is repugnant.

It is best to restrain the intake of fluids especially with meals and as a result thirst often becomes very distressing. Beverages are preferably given in limited quantities between feedings. Fruit juices are often more satisfactory than plain water. Where thirst is incessant and cannot be controlled by mouth it is necessary to employ rectal enemata for relief.

Lavage.—Stenosis that has reached the degree permitting food stagnation calls for gastric lavage. This is best practised before breakfast to rid the stomach of the overnight accumulation. If necessary it may be repeated again before the evening meal. Lavage gives great relief and frequently maintains the patient in comparative comfort for a considerable period of time, but is a purely palliative measure. It should be done with plain warm water.

RECTAL FEEDING.—Rectal alimentation at best is of doubtful advantage. If practised in pyloric stenosis, mouth feedings should still be continued, even if in much reduced quantities. It is surprising to see how quickly the pylorus closes when all feeding is discontinued.

Hot stupes to the abdomen are indicated for relief of pain and nausea.

Medication.—No medicinal cancer cure has been discovered, though, many preparations have been tried and have been discarded. Drugs are only of use insofar as they may help or allay many of the distressing symptoms which occur in the course of the disease. Too often our best therapeutic acumen meets with but partial success.

Hydrochloric acid is called for where the gastric secretion shows a sub- or anacidity. To be effective it must be given in fairly large amounts,

1 to 2 cc. (15 to 30 minims) in a wineglass of water 20 to 30 minutes after meals. Very frequently this dose can with advantage be doubled by giving it with meals and afterward.

As a stimulant to appetite and to relieve nausea, the bitter tonics are useful, such as condurango, tincture of gentian, and cinchona. Condurango is probably the most effective. Aaron recommends that it be given as a decoction.

Corticis condurango is macerated for twelve hours with distilled water, and of the resulting liquid, a tablespoonful, three times a day before meals, is administered.

ANODYNES.—As mild anodynes the tincture of valerian and compound spirits of ether are of service. I have found anæsthesin and orthoform often of benefit in relieving pain.

As the disease progresses the use of morphine or morphine and belladonna will have to be resorted to. It is always well to delay their use as long as possible. For the control of nausea and vomiting a 5 per cent. solution of cocaine in 0.2 cc. (3 minim) doses can be used. Chloroform is also useful.

The following prescription is one I have often found useful:

Menthol. 0.03 gram ($\frac{1}{2}$ grain)
Resorcin 0.06 gram (1 grain)
Brandy 4.0 cc. (1 dram)
Water ad. 16.0 cc. (4 drams)

Dessert to tablespoonful on cracked ice before meals. Resorcin is of value when fermentation is present.

Obstruction at the Cardia.—In growths involving the cardia, the same dietetic rules apply as in pyloric stenosis. The food must be of a liquid or semi-solid consistency.

Olive oil is of value, for, in addition to its nutritive qualities it is of real service in lubricating the passage and allowing food to pass more readily. A wineglassful, warm, can be taken before the morning and evening meals. Almond milk is a substitute for olive oil if the latter becomes distasteful.

When the stricture becomes so tight that liquids and oil fail to pass into the stomach, a great deal of relief can be given by systematic lavage. This is done by introducing a tube down to the cardia and aspirating the food residue, after which the œsophagus can be washed with plain warm water or a bicarbonate of soda solution until the return flow is clear. Lavage should be practised at first once a day, later twice. Food can be taken half to an hour afterward.

Keeping the cardia open by the passage of sounds is worthy of trial. Objection has been made to their use on the ground that the mechanical trauma may increase the extension of the growth. Considering the nature of the disease this in itself would hardly prohibit their use.

I was able to give supplemental feedings in a case of carcinoma of the cardia, with the aid of a Jutte tube. The tube was introduced with the stylette until the obstruction was reached, then the stylette withdrawn. In the course of an hour or so by giving small sips of milk, the tube succeeded in passing into the stomach, when a pint of milk with two eggs, milk sugar and somatose was introduced into the stomach.

Mouth feedings should not be stopped, for the cardia closes rapidly, when the passage of all food is discontinued. Mechanical dilatation of the carcinomatous stricture hardly seems warranted. Antispasmodics are recommended. I have not seen much benefit from their use, save for morphine which serves to relieve pain and discomfort.

X-Ray.—To-day no satisfactory results have been obtained from x-ray therapy. It is too early yet to draw any conclusion from the machines of high voltage that are now in use. Two observers with whom I have had personal communication, speak in a very encouraging way of the results so far obtained.

Complications.—HEMORRHAGES.—Hemorrhage is a common finding in gastric carcinoma, while active hæmatemesis is not so frequent. Small quantities of "occult blood" are found either in the stools, stomach washings, or vomitus, in over half the cases at some period of the disease. Many times the oozing is self-limited, stopping without any particular treatment—again its persistence and proportion will call for energetic treatment.

The treatment of hemorrhage in gastric carcinoma is that of hemorrhage in general. The patient must be put in bed, all food withheld by mouth, and an ice cap applied to the abdomen or suspended from a frame to avoid pressure. Morphine should be given to relieve pain and quiet restlessness; it must be given in full dose to be effective, and repeated at intervals of from 3 to 6 hours. The addition of atropin helps to relieve spasm. Codeine phosphate hypodermatically, 0.065 to 0.1 gram (1 to 1½ grains), may be substituted.

The Murphy drip or saline enemata are indicated to relieve thirst, and for their stimulating effect. The fluid should be given hot, 120° F.

Ergot and emetine hydrochloride both have a hæmostatic action. They may be administered hypodermatically and are worthy of trial.

I have had very good results with gelatine. This is prepared commercially in sealed ampoules of 10 per cent. and 20 per cent. strength. It is liquefied by immersion in warm water, then it may be drawn up in a syringe and injected subcutaneously.

Coagulose is a hæmostatic ferment obtained from normal horse serum. It is prepared in 0.6 gram (10 grain) glass bulbs. It is used by adding a few cc. of warm sterile water (95° F.) and injected subcutaneously. Good results are reported from its use.

Epinephrin solution (1-1000) given in doses of 1 to 2 cc. (15-30 minims) three or four times daily has given good results in some cases.

Bismuth salts, have a slight astringent action and have been used very generally in hemorrhage. A protective coating is formed on ulcerated and denuded areas.

(f) GASTRIC NEUROSES.

General Considerations.—As medical diagnosis has perfected itself, largely through the x-ray and experience gained by surgeons in abdominal operations, various forms of indigestion, formerly classed among the neuroses, are now shown to be dependent upon demonstrable organic disease. It is not so long ago that many cases of appendicitis, in which there were no physical signs or history of definite attacks, gave rise to gastro-intestinal symptoms which were classed as neuroses. Lesions of the gall-bladder have also been placed upon a more definite basis and have been shown to be the exciting cause for reflex disturbances of the stomach, hitherto obscure. Painful sensations, formerly ascribed to gastralgia and neuralgia, are now known to be gastric and duodenal ulcer. Further instances might be given, but these examples are sufficient to show how accumulating experience has resulted in transferring many forms of indigestion from the neurotic group to that of definite organic disease. Undoubtedly time will add more.

The theory evolved by Eppinger and Hess, that changes in the endocrines, through changes in tonus transmitted through the autonomic nervous system, give rise to nervous dyspepsia, influencing tone, peristalsis, and secretion, can account for many conditions heretofore regarded as purely functional.

Alvarez regards the intestinal tract as graded downward, the muscles nearest the cardia showing a tendency to greatest rhythmic contraction, while those from the pylorus are slower in starting. There is a progressive gradient all the way down—according to Alvarez this “underlying gradient of tone might be an essential factor in determining the direction of peristalsis.”

Alvarez further demonstrated a gradient for oxidation and carbon dioxide in the wall of the intestine, underlying and giving rise to other gradients of tone and rhythmicity, the chemical process progressing at a more rapid rate in the duodenum than it does in the lower bowel. Therefore, stagnation is not always due to failure of peristalsis, but by unequal effect of toxins on muscles at two ends of an organ. The gradients may be reversed by any disease irritation or inflammation, (Meltzer's law of contrary innervation in relation to stomach and intestine).

For the present we may describe the functional gastro-intestinal disturbances as those of primary origin where the nervous mechanism is affected; and those of a secondary nature, in which there is a primary lesion in the brain, spinal cord, or in other organs as the kidney, spleen, liver, or pelvic organs. According to Dock, focal infections of teeth, tonsils, or sinuses, may give rise to reflex symptoms in the gastro-intestinal tract.

The gastro-intestinal neuroses due to various primary abnormalities in the autonomic nervous system may be classified as follows:

GASTRIC NEUROSES.

VAGOTONIC GROUP.

Cardiospasm
Pylorospasm
Peristaltic unrest
Pneumatosis
Nervous vomiting
Eruetatio nervosa
Rumination
Regurgitation
Gastralgia
Hyperæsthesia
Bulimia
Parorœsia
Gastromyorrhœa
Hyperchlorhydria
Gastrosuccorrhœa

SYMPATHETICOTONIC GROUP.

Atony
Incontinence of the pylorus
Acoria
Anorexia
Achyilia gastrica
Hypochlorhydria

INTESTINAL NEUROSES.

VAGOTONIC GROUP.

Fermentative dyspepsia
Nervous diarrhœa
Enterospasm
Spastic constipation
Enteralgia
Hyperæsthesia
Peristaltic unrest
Meteorism
Mucous colitis
Spasm of anal sphincter

SYMPATHETICOTONIC GROUP.

Atony
Constipation (atonic)
Paralytic ileus
Relaxed anal sphincter

Treatment.—The treatment of this group of functional disorders should be both general and specific. The general treatment is similar for every type of gastro-intestinal neurosis and may be considered here for the whole group.

General Treatment.—Under general treatment are included all measures which aim to improve the general health of the individual. Much may be accomplished by the manner of the physician, inspiring confidence in the patient. Often a quiet talk will go far in ascertaining the mental problems of the individual, and, as far as possible, to advise him in regard to his difficulties.

Regulation in the mode of living implies regular hours for meals and sufficient sleep. Exercise should be advised, either in the form of calisthenics, setting-up exercises, or such games as golf, which is especially suitable to those in a generally run down condition, as it makes no severe physical demand. The great advantage of games over setting-up exercises is the mental diversion afforded, often a very desirable factor.

Change of scene creates new interests, and the freedom from home and business routine helps restore the nervous balance. For this reason it is desirable whenever possible that the patient go away to some quiet resort.

In atonic conditions, exercises especially adapted to increasing the tone of the abdominal muscles, and direct stimulation of the abdominal

viscera by massage, increases peristalsis, improves blood supply, and thereby the secretion of the gastric juice.

Hydrotherapeutic measures are often employed with advantage. They are local, restricted to the abdomen, or general such as friction to the whole body, wet packs, salt rubs, full baths and general douches; all tend to improve the nervous tonus. The warm moist compress, applied to the abdomen and kept at a fairly even temperature by means of a hot water bag or electric pad, is useful in many conditions of spasm. In highly nervous persons and in those who cannot relax, the wet hot pack is of especial advantage, followed by a brush massage, and in many instances induces a state of relaxation followed by sleep. It would seem logical to rely on hygienic measures as far as possible rather than on drugs to produce relaxation and sleep.

Diet.—As a rule, it may be said that the functional neuroses need food, and little if any result will be obtained by curtailed diets. The vast majority of these patients have been on restricted diets or have restricted themselves, as they invariably feel more comfortable the less they eat. They have gradually eliminated one thing after another, until the general nutrition becomes much impaired with a consequent loss of weight. It is surprising how soon an atonic stomach can take its quota of nutriment under systematic regulation of food, fresh air and rest.

A general schedule of diet would be somewhat as follows:

8.00 Breakfast; rest 20 to 30 minutes before bath and dressing.

11.00 glass of milk with $\frac{1}{2}$ ounce of cream. Butter milk, fermilac or malted milk may be taken if preferred.

1.00 Lunch; an average portion of the lighter meats, such as fish, chicken, lamb, or ham; two vegetables, one green, one starch; lettuce or endive salad with plain dressing; a dessert of farinaceous pudding or stewed fruit, preserves or junket, baked custard, Brown Betty. Rest one hour in recumbent position loosening clothing.

4.30 Cocoa or milk as at 11.00

7.30 Dinner. Soups may be taken if the appetite is lacking. The clear beef soups are indicated owing to their stimulating properties to gastric secretion. In cases where hyperacidity is present it is well to eliminate consommé and substitute the thick soups or purées, such as purée of split peas or beans, making them without meat stock. The remainder of the dinner may be similar to the food taken for lunch.

Fluids at meal times should be restricted, especially if a high grade atony exists. Coffee and tea are not allowable.

Starch is not well borne by many dyspeptics on account of its liability to ferment and the quantity of gastric juice required for its digestion. Campbell protests against starchy food in the form of pap on the ground that it must be swallowed at once without any chance of salivary digestion. Starchy food in the solid form requires a good deal of mastication and allows the saliva to initiate its conversion to sugar. Dry breads, such as toast, pulled bread, crackers and zwieback are for this reason more desirable than ordinary breads.

It is well to eliminate raw eggs as Mendel has shown that uncooked egg albumin fails to stimulate gastric juice and is antipeptic, calling forth no flow of bile and strongly resisting the action of trypsin. Eggs are poorly utilized and may cause diarrhœa, all of which is obviated by cooking.

The meat extracts are stimulant to hydrochloric acid although they cause little secretion of pepsin. For this reason they are contraindicated in hyperchlorhydria but are beneficial in cases with diminished hydrochloric acid secretion.

REST CURE.—The so-called rest cure is of benefit in many cases of functional gastro-intestinal disorder. These sufferers in extreme cases undergo a marked degree of malnutrition, they suffer from apprehension and anxiety, are unable to consistently carry out any measures in their own homes toward their relief. When they try to increase their nutriment they suffer untold distress. In other words, they reach a state of mental and physical demoralization which renders them unable to help themselves. The enforced rest in bed with the maintenance of a regular regimen directed to their improved nourishment and restoration of confidence, is of value in many cases.

"Rest cures" should preferably be undertaken outside the home of the patient. In the home atmosphere too much is going on which helps to foster a state of nervous tension. The patients listen for the door bell and telephone, and hears the echo of family life which they wish to enter and yet know that they cannot. In the conduct of a successful rest or nutrition cure much depends on the general surroundings, the tact and personality of the nurse and of the physician. The period of rest in bed also affords opportunities for observation and study of the individual, and may lead to the clearing up of a diagnosis which might otherwise remain obscure.

An average daily regimen subject to certain modifications depending on the condition of the patient is the following:

7.45 Rise, wash hands, and face, cleanse teeth.

8.00 Breakfast. Rest 20 to 30 minutes.

9.00 Bath, tepid. Patient stands in bath or preferably lies on table, while nurse or attendant gives a brisk salt rub, covering extremities, back and abdomen; this is followed by a cleansing dip in tub and a cold spinal douche, a pitcher of cool water poured down spine and over chest for 10 to 15 seconds. Brisk rub and return to bed.

10.00, 11.30 or 12.00 Hot moist heat applied to abdomen.

11.00 Nutriment.

1.00 Lunch. Darken room and rest one hour.

3.00 to 4.30 Moist heat to abdomen.

4.30 Nutriment.

5.00 Hot pack, one half to three quarters of an hour.

7.00 Dinner.

9.30 Nutriment.

10.00 P. M. Lights out.

Light reading and the writing of a restricted number of letters is permissible. Visitors, as a rule, are at first best excluded.

REGULATION OF BOWELS.—It is surprising how many patients with functional gastro-intestinal conditions have suffered for years from stubborn and persistent constipation and, who under rest and relaxation, find their bowels beginning to move normally. The regulation of the bowels is conducted along the following lines: Mineral oil, 60 cc. (2 ounces), is given by mouth at night. The patient is directed to go regularly to the toilet after his period of rest following breakfast. He is instructed to make a constant effort, without forced straining. Pressure under the ribs on both sides with the hands, is of help as it increases peristalsis through nerve stimulation. If, after a period of five minutes, there is no result, he is sent back to bed, and directed to dismiss the subject from his mind, unless the call becomes imperative, being reassured at the same time that it is not a question of great importance whether his bowels move or not. A footstool raises the knees and simulates more nearly the normal squatting attitude of defecation.

Every other day, if there has been no result or if it is deemed of an insufficient amount, an enema of bicarbonate of soda is given, or, in cases of an exceptionally stubborn nature, 60 cc. (2 ounces) of mineral oil is introduced in the rectum at bed time and retained over night.

It is surprising to watch the good results which are obtained by following this regimen. Usually at the end of the week the quantity of oil by mouth can be reduced to 30 cc. (1 ounce) or even 15 cc. ($\frac{1}{2}$ ounce), and the enemas are no longer necessary. In almost all of these chronically constipated people there is a deep-seated fear, fear that the bowels "will not move," and that, if they do not, they are being "poisoned." It often takes much reassurance on the part of the physician to counteract this feeling of fear and apprehension. Their very anxiety is often a cause of inhibition.

DRUGS.—The functional gastro-intestinal case needs but comparatively little special medication. Where a relatively high acidity exists in certain cases of atony, it is well to ignore its presence provided it is not accompanied with any degree of pylorospasm. The acidity returns to normal as the nervous balance is restored under general hygienic measures. There are however certain cases of hyperchlorhydria which are accompanied with painful spasms. In such cases atropine or belladonna, and the use of alkalies are helpful. Alkaline treatment in the neuroses should be regarded as a temporary measure, the ultimate results being derived through the general improvement of the physical condition.

To quiet the nervous reflexes bromide is the drug par excellence, and the following prescription has proved a very useful way of administering it:

Sodii bromidi	0.3 gram (5 grains)
Spiritus anisi	1.0 cc. (15 minims)
Aquæ chloroformiad	4.0 cc. (1 dram)
M. Signa.	Teaspoonful three times daily after meals.

The writer has never seen any gastric disturbance following the use of bromide in this form.

The special treatment of various forms of the gastric neuroses follows. It should be thoroughly understood that every patient of the neurotic class of gastro-intestinal disorder requires the attention to building up the general health which has been outlined in the preceding paragraphs.

Cardiospasm.—Mild cases may yield to a soft diet, the use of bromides and the systematic use of bougies. The latter should however be used with caution in cases of long standing, as the œsophageal walls may have become ulcerated and the bougie will then increase the spasm. Belladonna has been useless.

In more severe cases the method giving the best results is direct stretching of the cardiac sphincter by means of the Plummer or the Einhorn dilator. Seldom are more than two treatments required.

Pylorospasm.—The treatment of pylorospasm should be directed to a search for the underlying factors. Clinical evidence would point to the fact that hyperacidity in degrees such as is usually experienced, is in itself not sufficient to produce painful contraction of the pylorus. Peptic ulcer, chlorosis, cholelithiasis, chronic appendicitis and colitis are the organic conditions which are most frequently associated with it. It has been found due to slight cardiac decompensation, to menstrual irregularities and to lesions of the brain or spinal cord.

When such complicating lesions cannot be found the treatment should aim at the improvement of the general hygiene and regulation of the diet. Food should be bland and non-irritating, but at the same time should be sufficient to maintain adequate nutrition. Feedings between meals are desirable, and short periods of rest after the principal meals are advisable. Heat applied to the epigastrium after eating is of decided benefit.

Drugs.—Bicarbonate of soda 2 to 4 grams ($\frac{1}{2}$ to 1 dram), with small doses of bromide or of belladonna, given before the usual time of onset of the distress will be of great temporary aid.

Peristaltic Unrest.—When excessive peristalsis in the stomach is not due to pyloric stenosis the treatment must be directed to the general neurasthenic condition.

Pneumatosis.—Excessive distention of the stomach with air is at times associated with cardio- and pylorospasm. It occurs both as a primary neurosis, and secondarily with atony, dilatation and paralytic ileus. The treatment should be directed toward the nervous system.

Nervous Vomiting.—The treatment is directed toward determining the cause. Children who are overworked or worried in school should have fewer hours at school and fewer lessons at home. Attention must be paid to the diet—that the quantity is sufficient with plenty of milk, cream, and vegetables. Cod liver oil, in spite of its taste, works well in many of these cases.

In extreme cases, rest in bed may be necessary with small and frequently repeated feedings.

DRUGS.—Bromides are of service, and if they cannot be retained by mouth, may be given per rectum. Codeine and morphine should be avoided as much as possible on general principles.

In children small doses of thyroid, 0.0006 gram ($\frac{1}{100}$ grain) twice daily have often given good results. I have used it more or less empirically but am satisfied that it is of benefit.

Nervous Nausea.—This condition is usually associated with anæmia or chlorosis or with menstrual disorders. The anæmia should receive appropriate treatment. Fresh air and mild regular exercise are of value. In women who experience scanty and delayed menstruation, good results follow the use of ovarian extracts.

Rumination and Regurgitation.—Meals should be eaten slowly and care taken that they are thoroughly masticated. Rest for short periods before and after eating is frequently helpful. Attention must be paid to the general hygiene.

Gastralgia.—Gastralgia is not a clinical entity but a symptom of a number of disorders. Strictly speaking the term should be used only to describe a primary neurosis of the vagus nerve which is not dependent on organic disease. Schmidt suggests that the term be supplanted by the expression sympathetic or vagus neuralgia, with the addition of the underlying cause. The treatment should be directed to the primary condition.

Immediate relief from pain may be obtained by heat applied to the abdomen, the hypodermic use of atropine sulphate, 0.0005 to 0.001 gram ($\frac{1}{120}$ to $\frac{1}{60}$ grain), when the paroxysms are severe. or the use of codeine or morphine in extreme cases.

An enema, by unloading an overdistended and irritable bowel, will frequently afford prompt relief.

The diet should be carefully adjusted even where the primary cause is extra-gastric, as the stomach usually shares in the general irritability.

Regular normal meals should be taken. Foods which are mechanically non-irritating are best, and those stimulating to the gastric secretions should be avoided.

Hyperæsthesia Gastrica.—The treatment of such an oversensitization of the gastric mucous membrane must be directed to the nervous system. Rest in bed may be necessary. Bromides, valerian and gastric lavage with either plain water, 1 to 10,000 silver nitrate solution, or sodium bicarbonate solution are helpful.

Aerophagia.—This condition may at times be due to an increased flow of saliva, due to hyperchlorhydria. Alkalies and bromides will tend to counteract this nervous reflex. Piedrabita suggests the placing of a cork between the teeth for fifteen minutes at a time especially after meals, to prevent the act of swallowing.

Bulimia and Acoria.—These conditions, the first an abnormal hunger, the second an absence of normal sense of satiation are closely related. They may be independent neuroses or related to an organic affection. The treatment, when it is a secondary disease, must have regard to the removal of the

primary cause. When associated with neurasthenia, general hygienic measures must be employed.

Hyperacidity.—(Hyperchlorhydria).—The experience of the writer has been that hyperacidity does not give rise to symptoms without a disturbance of gastric motility. The overindulgence of hearty eaters in rich food or that to which they are unaccustomed, or of others in tobacco may cause symptoms which are ascribed to hyperacidity. Occasionally the ingestion of an unusual amount of acid fruits or drinks is followed by symptoms of hyperacidity.

The treatment should be directed toward the regulation of the diet, reducing or eliminating the consumption of nicotine, tea and coffee, the prescription of regular hours for sleeping, eating, and rational exercise.

For symptomatic relief alkalies may be used, either bicarbonate of soda, or where constipation exists, a combination of calcined magnesia and bicarbonate of soda.

The diet should be of a soft non-irritating character, the use of such articles that especially stimulate secretion, such as clear broth, spices, peppers, radishes and mustard should be forbidden. As fats inhibit gastric secretion, the free use of butter and cream is desirable. Olive oil in teaspoonful doses before meals causes a regurgitation of bile in the stomach, neutralizing the gastric juice.

Gastrosuccurrhœa.—(Hypersecretion). The general principles referred to in hyperacidity and pylorospasm apply here. The diet should be restricted to a bland non-stimulating character. Milk junket, baked custard, thick barley, rice broths made without meat stock, and eggs are best. The patient should have complete or partial rest in bed, and all emotional stimuli should be removed as far as is possible.

In the control of the excessive secretions atropine is of decided clinical benefit. Crolm and Reiss have shown a reduction in the amount of the secreted fluid after the hypodermic administration of this alkaloid. Bastedo maintains that "in cases with continuous secretion, atropine in maximum doses ($\frac{1}{15}$ grain) by hypodermic syringe, given either before or after meals, does not lessen the acidity or the secretion of the digestive period, and may even increase it; but it may result in a stoppage of the continued secretion in a reasonable time after food has left the stomach."

As an aid in the control of the nervous factor, bromides are of service. The sodium salt given in doses of 0.6 to 1 gram (10 to 15 grains) two to four times daily will not cause any gastric irritation.

When constipation exists every effort should be made to control the bowels without the use of drugs. Mineral oil and enemata are preferable to the vegetable cathartics.

Atony.—Atony may arise as the result of a number of causes, among which may be mentioned neurasthenia from overwork and worry, dietetic indiscretions, and overeating, and rapid eating, the drinking of large amounts of fluid with the meals, and secondarily after such wasting diseases as typhoid fever, tuberculosis and anæmic states.

Treatment should be directed to the general condition. The diet should be sufficient and wholesome, "good home cooking," avoiding rich, or highly spiced food. The quantity of water with meals should be curtailed to amounts not exceeding four ounces, the balance to be taken between meals. Tea and coffee are best forbidden except with breakfast, which is normally a small meal. In severe cases it is sometimes well to avoid soups, to curtail the excess of bulk in the stomach. Aerated drinks should be forbidden owing to the resulting distention.

Regular moderate exercise is of the greatest benefit, either in the form of calisthenics or games. If the individual is undernourished, small feedings between meals are indicated, such as milk, either sweet, malted, butter-milk, or fermilac. Short periods of rest in the recumbent position are beneficial after the principal meals.

Constipation is frequently a troublesome factor. This should be treated dietetically; by the use of stewed fruits, green vegetables, cream and butter.

It may be necessary to give mineral oil 30 cc. (1 ounce) or more at bed time, or in divided doses between meals, or a mild saline.

In those of a highly nervous temperament sodium bromide, 0.6 gram (10 grains), with chloroform water, 4 cc. (1 dram), after meals is of service in the initial stages of treatment. I have seen but little benefit from the use of nux vomica or strychnine.

The duodenal tube has been recommended as a means of feeding the atonic stomach. It may be of service in certain cases but the idea does not seem logical. The organ must be trained to do its work.

Achylia Gastrica.—Under the term "achylia gastrica" are included conditions in which hydrochloric acid is absent from the gastric juice, both in the free and combined form.

It can be divided into a primary or simple form which may be congenital or develop from hereditary predisposition, and a secondary form due to atrophy of the gastric mucosa. Also in some instances it is present as a pure neurosis. Achylia gastrica can exist without giving rise to any symptoms.

The treatment is largely a dietetic one, with attention to the general health. The diet should be nutritious and easily digested. Many of the cases are suffering from general lack of nutrition. Light meats, as chicken, squab, lamb, and ham, with occasional small allowances of scraped beef, may be allowed. All meat should be cut very finely and be thoroughly masticated. Vegetables, such as spinach, peas, beans, carrots, etc., are best passed through a sieve. Milk is often poorly tolerated although cream and sweet (unsalted) butter are well borne and are desirable from the nutritive standpoint.

In the more severe cases with marked malnutrition, especially those with diarrhoea, rest in bed is essential, where a regular rest cure regimen can be carried out.

Hydrochloric acid is often of benefit. It should be given with pepsin and administered in doses of 1 to 2 cc. (15 to 30 minims). My custom is to begin with 1 cc. (15 minims) in one-half glass of water, allowing the patient

to sip the solution with meals and repeating the same dose 30 to 45 minutes after meals. If the acid is well tolerated the dose can be raised. In some persons hydrochloric acid is not well borne. They dislike the taste or it produces burning in the pharynx or the stomach. I have had some good results with gastron (gastric juice of the pig, Fairchild Bros. & Foster), using it in doses of 15 to 30 cc. ($\frac{1}{2}$ to 1 ounce). Secretin may also be tried, giving 2 to 4 tablets with meals; it works well in some cases. Bicarbonate of soda will relieve the gastric discomfort and burning and can be given between meals. High intestinal irrigations are of service in removing irritating or fermentative products from the intestine and controlling diarrhoea.

Local infections in teeth, tonsils and gums should be carefully sought for.

Hypochlorhydria.—Treatment of hypochlorhydria should consist of a full, nutritious, finely divided diet. The use of hydrochloric acid alone or hydrochloric acid combined with the tincture of nux vomica is advisable. The main treatment is to be directed to the general psychico-physical condition, drugs playing but a minor part in the treatment. Regular exercise in fresh air, avoidance of overwork, and relief from mental anxiety as far as possible, are important.

iv. Diseases of the Intestines.

(a) ENTERO-COLITIS, ACUTE AND CHRONIC.

Acute enteritis is an acute catarrhal inflammation of the small intestine, following dietary indiscretions or the ingestion of tainted foods or over indulgence in fruit. It is especially liable to occur in warm weather, and certain individuals exhibit a susceptibility.

Treatment.—The offending substance should be removed by a dose of castor oil, which may be readily administered shaken up with an equal amount of the official rhubarb and soda mixture, or a course of calomel may be administered followed by a saline. In severe cases or for those with much prostration, bed is indicated. Abdominal distress may be relieved by hot applications or small doses of paregoric may be given. After the bowels have been thoroughly evacuated, bismuth subnitrate is useful in allaying the irritation.

In the acute stages all food should be withheld, and thirst may be relieved by cracked ice or small amounts of water. Later a soft diet is indicated, such as broth, junkets, tea, zwieback or baked toast, arrowroot gruel, until the diarrhoea has stopped.

Chronic Entero-colitis.—There is a chronic catarrhal inflammation of the small bowel which usually involves the cæcum and part of the ascending colon. It occurs chiefly after one or more attacks of the acute form, and an inflammation of either the small or large bowel will usually extend to the other part of the intestinal tract. Less common causes are carcinoma of the intestine, intestinal obstruction, or venous congestion due to pulmonary emphysema, hepatic disease, or a heart or kidney lesion.

Treatment.—The symptoms are stubborn and long periods of treatment are usually necessary.

The diet plays the most important rôle. In a general way it may be said that in the small intestinal type of non-specific infection a high protein diet is well borne and often effective, while in the colonic infections, protein digestion is frequently disturbed, with resulting putrefactive and alkaline stools. The colonic types tolerate carbohydrates better than do the small intestinal infections.

Schmidt's test diet is useful to measure the digestive capacity of the bowel, and can be employed with advantage in regulating the dietetic requirements of these cases. The food must be well prepared, soft, free from fibre and coarse indigestible particles.

In the mild cases, without diarrhœa but with numerous abdominal symptoms, such as meteorism, abdominal pains and loss of strength, a fairly liberal diet may be employed. The softer meats such as sweetbreads, calves brains, fish, chicken and ham are suitable. Eggs, soft cooked, are permitted. Preparations of gelatine are useful and are well tolerated. Sugar should be restricted and starches limited. The prepared flours of rice, barley, peas, and beans are often useful and to be preferred to the coarser and less digestible forms of starches. Breads should be dried. Soft vegetables are asparagus tips, or spinach and should be passed through a sieve. The same should be done for potatoes and peas. Farina, rice and macaroni may be used. The coarser vegetables, such as cabbage, celery, onions, tomatoes, string and lima beans, are excluded. Desserts, such as cream or pot cheese, farina and rice puddings, junket, baked custard, calves foot jellies, fruits, either raw or stewed and candies and cakes are not permitted. Soups, barley and rice broth, clear broths thickened with flour of peas, beans, barley, rice or noodles are often useful. Cream and butter (unsalted) are permitted. Milk in many cases is poorly tolerated, the casein preparations being preferable.

In the more severe cases with fermentation and frequent attacks of diarrhœa, the diet should follow the same lines but should be more strict. Excess of fermentation calls for a more albuminous diet. Cocoa, junket, egg albumen, and unsweetened orange gelatine are suitable. As the fermentation subsides, carbohydrates may be gradually added as zwieback, educator crackers, barley, rice, pea and bean flour given in chicken or beef broth, and malted milk diluted with water.

In severe cases with persistent diarrhœa, bed is imperative. Nutrient must be markedly curtailed. If the diarrhœa persists, starvation or the use of albumen water are indicated. As the severity subsides the diet may be gradually built up along the lines indicated above. Hot compresses are useful in allaying pain and distress, and in quieting peristalsis.

Drugs.—Opium is to be avoided as far as is possible, as the disease is a chronic affection with frequent relapses. A habit is too easily acquired.

Bismuth subnitrate and bismuth subgallate hold first place in drug therapy, and should be administered in doses of 1 to 2 grains (15 to 30

grains) three or four times daily. Astringents as tannigen and tannalbin are often of service in helping to control the diarrhoea. Their effect is sometimes irritating and they should be given with caution, watching carefully the results.

Intestinal antiseptics, in these cases, are of service. Bismuth salicylate, betanaphthol and ichthyol are worthy of a trial. They may be given in combination with bismuth and their administration is repeated three or four times daily.

It should be borne in mind however, that the main treatment is diet and nursing. Supportive measures may be necessary. In all cases of chronic entero-colitis a high degree of individualization on the part of the physician is called for, because the condition is at best an exceedingly chronic one.

Chronic Duodenal Catarrh.—The treatment is essentially that of chronic gastritis. A soft diet is indicated. Duodenal lavage by means of a Rehfuß or Einhorn tube, using a normal salt solution, is often of benefit.

Colitis.—The disease may occur in conjunction with chronic enteritis or as an independent manifestation. It is usually met with in constipated people, especially those with visceroptosis, and its presence necessitates a thorough examination of the gastro-intestinal tract. The vast majority of cases that I have seen have been due to focal infection, most often the appendix, although the gall bladder is not always guiltless.

Mucous colitis is characterized by abdominal distress, constipation, mucus in the stools and nervous disturbances probably due to a disturbed metabolism. Much confusion apparently exists in the classification of mucous disease of the colon. It has impressed the writer as being more of degree; the higher the process extends, the more marked the symptoms. The rôle that intestinal toxæmia plays in colitis is a confused one and remains yet to be elucidated. That the formation of mucus takes place on a purely nervous basis does not seem convincing.

The treatment for colitis has been outlined under membranous colitis (page 329). It is directed to the cure of constipation and improvement of the general neuro-psychiatric condition. A careful search for focal infections in the appendix, gall-bladder or female pelvic organs should be made.

Sigmoiditis, Proctitis.—Localized inflammation of the parts of the intestinal tract are more amenable to treatment owing to their comparatively easy accessibility. By means of the sigmoidoscope they permit of carrying out local treatment.

Treatment.—The constipation should be regulated by diet. The relief of the constipation, and the removal of the accumulation of fæces from the rectum is all that is required in the majority of cases.

In the interstitial form a saline laxative is indicated. Salines are absorbed from the upper portion of the small intestines and are exuded from the mucosa of the lower colon. In this form of inflammation they are almost specific.

Local treatment may be instituted, medication being directly applied through the pneumatic proctoscope. A useful application is equal parts of bismuth subcarbonate and calomel introduced through the sigmoidoscope by means of the powder blower, or a solution of ichthyol, 10 per cent. in water, may be employed. A weak solution of silver nitrate, 1 in 500 of water, may be applied directly to the mucous membrane.

(b) DIARRHŒAL DISORDERS OF INFANCY.

The treatment of the diarrhœal disorders of children varies considerably according to age. That of older children does not differ in most particulars from that of adults. The treatment of the diarrhœas of infancy should be obtained in any standard book upon the diseases of infancy and early childhood.

(c) ULCERATION OF THE INTESTINE.

Ulceration of the bowel is met with as a result of necrotic, inflammatory, and infective processes, acute and chronic constitutional diseases, and toxic states. We will confine ourselves here to the consideration of ulcers of necrotic and inflammatory origin. Ulcerations due to specific infections are discussed in their special sections, and ulcer of the duodenum of the simple peptic type is considered in the section with gastric ulcer.

Duodenal Ulceration Following Extensive Burns.—Curling in 1842 first called attention to the relationship between duodenal ulceration and cutaneous burns. Many theories have been offered for their causation, but no satisfactory explanation has yet been given to explain their causation. They may be single or multiple and are usually fatal.

From the standpoint of treatment there is little one can do to control the diarrhœa. General supportive measures should be used, with morphine to control the pain.

In the embolic, thrombotic, and amyloid types the treatment resolves itself into that of the primary disease.

Stercoral Ulceration.—This form of ulceration is the result of the irritative action of inspissated fæces, and the removal of the offending mass is usually sufficient to insure recovery. Castor oil and enemata are usually effective. The existing constipation should be combated by dietetic measures.

Follicular and Catarrhal Ulcers.—These lesions occur with chronic enterocolitis and care should be taken to exclude infection with *amœba histolytica*. The condition is one very prone to pursue a chronic course.

Treatment.—It is possible in some of the milder cases to carry out ambulatory forms of treatment, but in the more advanced ones, with much diarrhœa, and especially those showing loss of weight and strength, bed must be insisted upon as a preliminary measure.

Diet.—The regulation of the diet is the first essential. This is governed somewhat by the portion of the bowel involved. In small intestine ulcer-

ation a high protein diet as a rule is well borne. In these cases we may give light meats and fish with the more easily digested carbohydrates, such as zwieback, baked toast, gruels with small amounts of butter, cream cheese, milk, and gelatine preparations. Small feedings at frequent intervals are best. In cases with an alkaline putrefactive stool, containing an abundance of mucus, meats should be restricted or entirely eliminated. Milk, gruels, junkets, creamed toast, macaroni or noodles should form the diet. Later, with improvement, proteins may be cautiously added, preferably in the form of scraped meats, tender well-boiled fish, or eggs.

Hot applications are useful to control spasm. It may be necessary to use some preparation of opium if the diarrhoea or pain is severe.

Bassler speaks in favor of autogenous vaccines in the coli infection cases. I have given them a fairly extensive trial, but must confess that, on the whole, the results have been disappointing. However, I believe they are worthy of further trial.

Transintestinal lavage is of value. The bowels may then be flushed with hypertonic solution of sodium sulphate and sodium chloride, twice or three times per week.

Objection has been raised to high colonic irrigations on the ground that they will carry the infection upward and cause an extension of the process. I cannot feel that this position is well substantiated, and certainly they do afford much relief and are in my experience of benefit. Irrigations may be given of silver nitrate 1 to 10,000 or stronger. Tannic acid 1 to 200 may be used if the silver nitrate solution gives rise to violent reactions of a spasmodic nature. A 20 per cent. solution of gelatine given hot will help bring away mucus.

As the acute process subsides, rectal instillations of from 100 to 150 cc. (3 to 5 ounces) of silver salts as weak solutions of silver nitrate, or albargin 1 to 1000 may be injected and allowed to remain over night.

The administration of such drugs as bismuth subnitrate and bismuth subgallate, chalk and charcoal may be tried. They are not often productive of much result.

The course of the disease is apt to be punctuated with many relapses. In many the integrity of the intestinal mucosa is so damaged that it is questionable if a cure in the complete sense ever takes place. These patients are very susceptible to body chilling and had best wear some form of flannel band. In others a change of climate during the winter months may forestall a recurrence.

In follicular ulcerations with undermining of the mucous membrane, or where polyps are present, medical measures alone are of little avail, and the question of cæcostomy or appendicostomy should be considered.

(d) INTESTINAL STENOSIS AND OBSTRUCTION.

The treatment of these affections is in the province of the surgeon with the removal of the causative factor.

(e) DILATATION OF THE INTESTINES.

Duodenal Dilatation, Chronic.—The chronic dilatations of the duodenum are reclassified into two subdivisions: those due to organic stenosis either a duodenal ulcer or adhesions or a tumor pressing upon the duodenum; and mechanical occlusion of the duodenum produced by traction on the root of the mesentery or constriction by congenital bands or adhesions. The condition is frequently associated with gastropptosis. It is the chronic form that is of chief interest to the gastro-enterologist from the therapeutic standpoint.

Treatment.—In general the treatment is that of gastropptosis. Improvement of the general nutrition, a supporting belt or corset, exercise and good general hygiene are points of importance. In cases with mild symptoms, much relief can be afforded by general medical treatment. In the more pronounced cases and those showing gastric retention, the treatment is surgical, duodeno-jejunosomy being the operation of choice. The acute cases call for immediate lavage of the stomach. The patient should stay in bed and the foot of the bed should be elevated.

Dilatation of the Colon.—The treatment of this condition depends upon the cause. When a tumor, volvulus or adhesions cause partial or complete obstruction, surgery offers the only relief. The affected part of the intestine may be excised or it may be necessary only to remove the cause of the obstruction.

Treatment of Idiopathic Dilatation (Hirschsprung's Disease) is unsatisfactory, and in most cases surgery, with complete resection of the colon, offers the only relief. In a few patients constant and scrupulous care of the bowels may give relief.

(f) DIVERTICULITIS.

Diverticulæ (diverticulosis) of the colon and sigmoid are usually found in obese men of late middle age, most of whom give a history of the long continued abuse of purgative drugs.

Inflammation of one or more of these diverticulæ (diverticulitis) may occur. There is pain in the left lower abdominal quadrant, slight fever, and sometimes nausea and vomiting. The illness seems much like a mild appendicitis except that the localizing symptoms are upon the left side of the abdomen.

Treatment.—The usual attack of diverticulitis subsides in a few days with rest in bed and the application of hot or cold compresses to the abdomen. The bowels should be moved, but enemata only should be used as laxatives increase peristalsis and may cause such pressure upon the appendage that it will rupture. It is said that rectal injections of cotton-seed oil are most effective.

If the inflammation progress to abscess formation, diagnosticated by increased pain and fever and the presence of a circumscribed tender mass, laparotomy and drainage must be done.

Prevention.—It appears probable that most cases of diverticulosis result from long continued purgation, which increases the strain upon the walls of the lower large intestine. Such constipation as may require a daily purge may usually be corrected by strict dietary measures which have been outlined on page 332. When constipation is very obstinate mineral oil may be used by mouth, or mineral or cotton-seed oil by rectum at the beginning of treatment.

When diverticulosis has developed the avoidance of purges is still more important, and proper dietary measures necessary. After constipation has been corrected it has been suggested that an attempt be made to fill the sacculæ with some insoluble and inert substance, such as bismuth subcarbonate, a dose of thirty grams (one ounce) being administered once weekly by mouth.

The frequency of the development of cancer in these lesions should be borne in mind, and if skiagraphy shows obstruction or narrowing of the lumen of the intestine, it is best to operate at once with the expectation of performing bowel resection if the disease has not progressed too far.

(g) APPENDICITIS.

Appendicitis, strictly speaking, is a surgical entity and medical measures are at the best palliative. The diagnosis once having been made the cure rests with the removal of the offending organ. It is true that many attacks of acute appendicitis subside under a bland diet and rest, but the ultimate history is almost invariably a recurrence.

Acute inflammation of the appendix demands both physiological and mechanical rest. Food should be either withheld entirely or given in the blandest forms, such as albumen water or broths.

Morphine and an ice-cap are useful to relieve pain.

Much argument has centered around the best time to operate. In the writer's opinion the time should be when the diagnosis is made.

Infection and disturbed motor functions resulting from pylorospasm may be an etiological factor in subsequent peptic ulcer and gall-bladder conditions. The incidence of association of peptic ulcer and chronic appendicitis is a frequent one and is one argument in favor of early operative interference.

(h) VISCEROPTOSIS.

The position of the viscera is maintained largely through the development of the thorax, and the abdominal pressure. In the narrow barrel-shaped chest of the congenital visceroptotic there is insufficient space for the organs of the upper abdomen and consequently the liver, spleen, kidney, and stomach are forced downward. A lowered intra-abdominal pressure is the result of a weakness of the abdominal and pelvic muscles. Such weakness is either congenital, as met with in those of asthenic habitus (*habitus enteroptoticus*), or acquired as the result of pregnancy, ascites, and intra-

abdominal tumor, or the accumulation of abnormal quantities of subperitoneal and omental fat.

With young persons, the majority of whom are women, presenting the asthenic habitus, as shown by the general low muscular development, the narrow costal angle and, in many instances, the unattached tenth rib, special prophylactic precautions may be taken.

There are many visceroptotics who, under ordinary conditions, experience little or no trouble but who break down as the result of fatigue, nervous strain or pregnancy and parturition. In these cases the individual becomes in many instances profoundly neurasthenic and suffers from a diversified symptomatology largely referable to the digestive tract.

Prevention.—It would seem that if the condition is recognized in early womanhood, especial care should be exerted to maintain a good general condition. The patient should have a reasonable amount of outdoor life, avoid fatigue, and an adequate degree of body nutrition should be maintained. The bowels should be carefully trained. The diet should be not only nutritive but laxative. Loss of weight with the reduction of peritoneal fat and an increased degree of ptosis, probably means added traction on the mesenteries which places the abdominal sympathetic nervous system in a condition of reflex nervous irritation.

Constipation is, as a rule, not the result of visceroptosis but a factor common in persons of asthenic habitus on account of the relaxed condition of the abdominal or pelvic muscles. The potential causes for constipation are present, and should be rigorously combated by diet and exercise. It is seldom that a dropped cæcum or ptosed transverse colon produces obstruction.

In the young, much can be done for thorax development by attention to body posture and by breathing exercise. In my opinion this is of real value, and, under a competent instructor, it is often surprising to see how much can be accomplished in the way of general physical development.

Treatment.—The neurasthenic manifestations of visceroptosis lead to reflex gastro-intestinal disturbances. There is little or no gastric distress so long as the stomach musculature remains normal, but with the onset of atony, food begins to cause discomfort and the diet is gradually reduced with a resultant loss of weight. From the loss of peritoneal fat the ptosis is aggravated and the digestive symptoms increase. The pain and discomfort increase the neurasthenic symptoms and thus a vicious cycle is formed.

General.—It is well to begin treatment with a period of *absolute rest in bed*. It permits of a physical rest as the majority of patients are fatigued; they also suffer from subnutrition and their diet is regulated, and in addition the rest in bed establishes a certain amount of self confidence. Such a period of rest must be governed by circumstances, but it should afford sufficient time to permit of a complete physical relaxation and an upward start in body weight. As a rule one to three weeks are required. Such treatment can be carried out at home, but the sanatorium or hospital has

the advantage of a new environment and the easier and better facilities of necessary dietetic requirements. The mental atmosphere has much to do with the success of these cases, and a great deal depends on the stimulating, encouraging influence of physician and nurse.

As soon as the patient is able to take a full diet without distress, and the acute period of fatigue has passed, much help is derived by *physical training*. This is best begun by setting-up exercises, special attention being paid to posture and breathing.

The use of an *abdominal support* increases the intra-abdominal pressure and materially adds to the general comfort. I have observed a number of visceroptotics under the fluoroscope wearing abdominal supports of different designs. The actual elevation of the viscera is little if any, but the relief of the abdominal symptoms is beyond question.

Diet.—The diet should be a general one. Neurasthenics as a rule do not tolerate meat well; also from protein substances alone there results a 12 to 15 per cent. waste in digestion as compared to 8 per cent. on a mixed diet. Before formulating the diet it is well to have a standard to start from, that is the amount of food required by the patient to maintain his individual body weight.

A patient in bed requires from 30 to 35 calories for each kilogram of body weight; confined to the room 32 to 35 calories; at light labor 35 to 40 calories; at heavy labor 45 to 50 calories.

Van Noorden calculates the approximate gain in weight under "forced feeding" as follows: A daily increase of from 500 to 800 calories gives a weekly increase of body weight from 600 to 1000 grams; 800 to 1200 calories yields 800 to 1200 grams increase, and 1200 to 1800 calories gives 1200 to 2000 grams weekly increase. Of the added calories only approximately 78 per cent. are assimilated, the remainder is used in digestion or stored as protein, while about 4 per cent. is lost in the fæces.

Proteins are given varying from 100 to 120 grams; carbohydrates offer a great variety to choose from and can be absorbed to the amount of 180 grams. Fat is valuable; it has a high index of combustion, and can be given in amounts varying from 180 to 250 grams per day. Two hundred grams of butter yields 160 grams of fat and equals 1400 calories. One liter of milk yields 33 grams fat and equals 300 calories, while 300 grams cream yields 75 grams fats and yields 698 calories. Thus fats, especially in the form of cream and butter are, for the most part, well tolerated, and their addition to the dietary makes it easily possible to construct a diet of high caloric value.

Proteins can be given in any form in the lean varieties of fish, meat and fowl. Nervous patients do better on low meat intake, and in such cases eggs, cheese, and milk should be prescribed. The artificial protein preparations are of service, when the appetite is poor, and the amount of food taken is small.

Carbohydrates offer a great variety of choice in the form of cereals, breads, sugars and certain vegetables. The diet in addition should con-

tain a fair amount of greens as spinach, lettuce, celery, etc., to increase the bulk of residue and produce intestinal peristalsis.

The diet is best constructed so that in addition to the three regular meals, "between feedings" are given in the mid-morning and mid-afternoon. Such feedings may consist of a glass of milk and cream, malted milk with the addition of extra cream, or some variety of sour milk as buttermilk, yoghurt, or fermilac. Cream may be added if desired.

To further increase the intake of fats, butter, made into small balls frozen in cracked ice, is served at the end of the three principal meals.

The diet in nutrition cures must be regulated by the condition of the gastric motility and secretions.

HYDROTHERAPY.—The use of moist heat to the abdomen, applied for two hours during the morning and afternoon, is very grateful to the patient. It does much to allay the abdominal distress and has a calming influence. Likewise the hot and cold pack is beneficial. These adjuncts are of real service in the nervously overwrought individual.

Although drugs play no direct part in the treatment yet they are of service in the control of certain symptoms.

DRUGS.—The hypodermic injection of sodium cacodylate stimulates metabolism, and is of service. It is especially indicated in cases with reduced hæmoglobin. Where a high acidity is present and gives rise to symptoms, the use of an alkaline is indicated. Where the gastric secretions are lowered or absent, hydrochloric acid is of service.

The bowels, as far as possible, should be regulated by diet, but frequently they require additional help. Liquid paraffin, as a rule gives good results. It is often of advantage to give it by rectum as well as mouth. Injected in the rectum at bedtime, if intestinal gas is not a troublesome feature, it can be retained over night without discomfort. Where insomnia or excessive nervousness exists, the use of sodium bromide, in doses of 0.6 gram (10 grains), two or three times a day, will often be found most helpful especially on beginning treatment.

As soon as the patient has shown that he is eating well and gaining weight, and that he has recuperated from the fatigue that is so pronounced a feature in many cases, calisthenics should be tried, starting moderately and gradually working up the amount of exercise, always being careful to avoid exhaustion. Massage plays an important rôle in strengthening the abdominal muscles. The technic is simple and can easily be acquired by the nurse or attendant, or the patient can practise it himself by means of the cannon ball.

Electric treatments are sometimes of use, and are always impressive to the neurotic patient. The faradic current is indicated in cases of poor intestinal tone, while the galvanic current seems to be of more service in the gastric pains of nervous origin.

The main object in the treatment of visceroptosis is to improve the nutrition, strengthen the general muscular tone, especially that of the abdomen, and to relieve the constipation. The neurasthenic manifestations

as a rule improve with the gain in weight and strength. In some instances, where the degree of malnutrition and neurasthenia are not too pronounced, this can be accomplished with but slight changes in the patient's mode of living, but where either of the above factors are pronounced, it is often impossible to accomplish much without a preliminary period of rest in bed.

(i) INTESTINAL NEUROSES.

A discussion of these disorders and the general medical treatment and upbuilding of the patient, which is the primary essential in the care of all neurotic disorders of the digestive tract, may be found under the section upon gastric neuroses. In this section only the special treatment for the various forms of intestinal neuroses is considered.

Fermentative Dyspepsia.—This disorder is characterized by a poor starch digestion as shown by faecal examination, accompanied by an increase of fermentative organisms. The proteins and fats as a rule are well digested. It is met with in certain cases of chronic entero-colitis.

Treatment.—The total amount of starch should be reduced. Bread is preferably used as baked toast. Cereals and cereal pudding should be at first eliminated; potato served mashed or baked may be allowed in moderate amounts. The tolerance for starch may be gradually increased. Little or no result is apt to be experienced from the use of pancreatic preparations. High colonic irrigations will afford symptomatic relief and should be used early whenever possible.

Nervous Diarrhoea.—Before the diagnosis is accepted great care should be taken that all other factors have been excluded. The treatment should be directed to the general condition.

Enterospasm.—Enterospasm is characterized by a condition of painful abdominal cramps. It is at times associated with uterine and ovarian disturbances, and with pathological conditions of the genito-urinary tract. The possibility of its reflex nature should be borne in mind.

Treatment.—The severe forms may necessitate the use of morphine or codeine, together with rest in bed and the application of heat to the abdomen. The diet should consist of such foods as will cause the least irritation of the gastro-intestinal tract, such as junket, baked custard and malted milk. Later a more general diet is allowed using the lighter meats such as chicken, fish, squab, scraped beef and creamed sweetbreads. Vegetables should be passed through a sieve.

Spastic Constipation.—Constipation of this type is characterized by an irregular spasm of the bowel, which is most frequently located in the descending colon and sigmoid, and is usually associated with neurasthenia, and often with muco-membranous colitis. In some susceptible persons tobacco and caffeine tend to spasm.

Treatment consists in attention to the general hygiene. The bowels should be regulated by a diet from which the bulk of the cellular residue has been removed. Green vegetables should be freely used, having been first passed through a sieve. In like manner prunes and apples may be used

either baked or in the form of apple sauce. The patient should take at least five glasses of water per day, starting before breakfast. Where malnutrition exists, butter and cream and the malt preparations are of service. Too much meat fat may result in intestinal sand and serve as a source of irritation to the intestine.

Hurst advises massage of the colon, confining it to parts in which the x-ray has shown stasis exists. This is usually the cæcum and ascending colon.

It is always well to begin treatment by thoroughly clearing the bowels by castor oil or enemata. In severe cases it may be necessary to confine the patient to bed with hot moist applications applied to the abdomen. It is desirable that the bowels be regulated as far as possible by diet but if this is impossible mineral oil and a mild saline can be employed. Belladonna is of value and in severe cases should be pushed to the physiological limit. In starting treatment in cases where constipation is pronounced, injection into the rectum of mineral oil is advisable. The patient should be in the knee-chest position and 90 to 120 cc. (3 to 4 ounces) is injected and allowed to remain in over night or until expelled.

I have always made it a rule in all cases of constipation or diarrhœa to make a proctoscopic examination. Not infrequently local inflammatory conditions may serve as contributory causes. When pronounced viscerop-tosis is present, an abdominal support in the form of a belt or corset is of help. By increasing the intra-abdominal pressure it renders the patient more comfortable and lessens gastro-intestinal irritability.

Hyperæsthesia of the intestines is frequently associated with a neuro-pathic state.

Peristaltic Unrest.—This affection may concern the intestine as well as the stomach, but the possibility of an obstruction should be carefully considered and excluded before the diagnosis is accepted.

Treatment in purely nervous cases is to be directed to the general nervous system.

Meteorism.—Meteorism is met with as a symptom in entero-colitis, and in conditions which interfere with normal bowel peristalsis, and is associated with organic obstruction.

Treatment.—The diet should tend to eliminate the coarser articles of food which might cause undue irritation. The bromides and valerian are often of benefit. Valerian may be prescribed in a capsule with lupulin.

Muco-Membranous Colitis.—This disease is characterized by attacks of abdominal cramps, with bowel discharges containing mucous and membranous casts. It is regarded by a number of writers as a secretory motor neurosis. It is confined almost entirely to those who have suffered from chronic constipation of the spastic type and with an hysterical neurasthenic background.

Van Noorden says, "the cure of colica membranous presupposes a cure of the constipation. Any method of treatment that causes a complete and permanent disappearance of constipation will also cause disappearance of colica membranous."

From the standpoint of differential diagnosis, muco-membranous colitis can be secondary to *rectal cancer*. It is occasionally met with in *chronic appendicitis*. Hurst regards the incidence of chronic appendicitis as a causative factor as being comparatively rare, in which observation my own experience would lead me to concur.

It is not infrequently met with in association with disease of the female pelvic organs, such as endometritis, displacements, pelvic cellulitis, etc. In rare instances muco-membranous colitis is complicated by an infection with pathogenic organisms. Visceroptosis is frequently present.

Treatment is symptomatic during the acute attack and causal of the disease.

The symptomatic treatment is directed to stopping the attack as soon as possible, the relief of pain and discomfort, and to prevent as far as possible the deleterious consequence that may follow both in regard to the nutrition and the general nervous system. In the attack the patient should be in bed, with hot applications applied to the abdomen. It is advisable to relieve the spasm by the use of an opiate, preferably a hypodermic injection of morphine and atropine, thus quieting the pain and relieving the intestinal spasm.

With the cessation of pain and spasm an attempt is made to relieve the bowel of the accumulation of fæces. This is best accomplished by warm water enemata followed by the slow injection into the rectum of warm olive or mineral oil, 180 to 240 cc. (6 to 8 ounces). It may be necessary to repeat the enema and the oil as it is seldom possible to evacuate the bowels entirely in one treatment.

The causal treatment is directed to the cure of the constipation and the improvement of the general nervous system. Von Noorden recommends a coarse diet, which Hurst regards as being often valuable but too irritating for severe cases. According to the latter the best results are obtained by a generous mixed diet, and as many of these patients are undernourished, with the liberal use of cream and butter. From personal experience it would seem that few cases tolerate the coarser forms of diet as suggested by Von Noorden. The following is a suggestion; it can be modified to meet special conditions.

Breakfast of cocoa or fresh tea; 1 to 2 slices dry toast; one tablespoonful of a well-cooked cereal; one egg in any form.

10.30 A. M.—Glass of milk with one ounce of cream.

Lunch—Fish, chicken, lamb, ham, brains, or sweetbreads. One green with one starchy vegetable given with each meal and selected from the following:—baked or mashed potato; macaroni; purée spinach, peas, beans, carrots, cauliflower, or asparagus tips.

With general improvement, small amounts of hearts of lettuce may be allowed with oil and lemon juice dressing, also celery.

Avoid fatty gravies.

Desserts: Simple farinaceous puddings, prune whip, prunes to be puréed, compote, stewed fruits, cream cheese, junkets, custards.

4 to 5 P.M.—Milk, plain or malted, or buttermilk if desired.

Dinner—Thick soup made preferably without meat stock; otherwise as per lunch. One slice baked toast allowed with lunch and dinner; butter freely.

Bedtime.—Glass of milk and cream.

Additional butter may be given in the form of small butter balls made up the size of a filbert packed in cracked ice. Eight to twelve of these may be swallowed in addition to that used with meals. The total amount of butter and cream per day should average at least $\frac{1}{2}$ pint of cream and $\frac{1}{4}$ pound of butter (unsalted). It is preferable at first that breakfast be taken in bed, followed by a rest period, and a rest of at least one hour be taken after lunch.

Constipation may be controlled by oil enemata, mineral oil by mouth and if necessary a mild saline.

Bromides are useful in controlling nervousness, and belladonna may be used to relieve any tendency to spasm.

Later, much can be done for the general condition by glycerophosphates and the hypodermic use of strychnine. Mild calisthenics, tonic baths and massage are all useful aids in building up the general condition. Non-fatiguing manual occupations are to be encouraged as soon as the general strength permits.

Spasm of the Anal Sphincter.—Such spasm is met with in nervous individuals, frequently associated with spastic constipation. It is produced reflexly by hemorrhoids, ulcer, acute proctitis, thread worms, and diseased states of the genito-urinary organs. It may accompany accumulation of pus in the rectum.

The treatment should be directed to the relief of the cause. A proctoscopic examination should be made to ascertain the presence of hemorrhoids, ulcer, or inflammatory states of the rectal mucosa.

Atony and Atonic Constipation.—Relaxed muscular states of the large intestine, involving principally the colon and cæcum, are observed in run-down, overworked, nervous persons. It is an accompaniment of wasting illness such as typhoid fever, dysentery, etc. The resulting constipation is probably due to deficient muscular tonus, and is frequently associated with visceroptosis.

Treatment.—The general condition must be improved and cathartics avoided. Abdominal massage is often sufficient to overcome the constipation in conjunction with a diet having an abundance of cellular residue.

Paralytic Ileus.—(Paralysis of stomach and bowel following operation.) The work of Cannon and Murphy has demonstrated the paralyzing effect of mechanical manipulation of the intestines. Care must be taken to exclude organic obstruction.

Treatment.—As soon as the condition has been recognized, the stomach should be thoroughly lavaged to remove all food remnants and relieve the distention. Lavage should then be repeated at frequent intervals as the stomach will distend again. The addition of bicarbonate of soda facilitates

the removal of mucus. General supportive treatment should be given according to indication.

The bowels should be evacuated with medicated enemata such as ox-gall in solution of glycerine.

Hot stupes should be applied to the abdomen.

The use of physostigmine salicylate in doses of 0.03 gram ($\frac{1}{2}$ grain) has been advocated. I have tried it in some cases of a lesser degree, and have not experienced much result. Its action is rather transitory, the effect lasting not over two to three hours.

Pituitrin is well spoken of by a number of observers. It has a cardio-tonic action and is especially indicated where a low blood pressure exists.

Schultz has used atropine with success in paralytic ileus and speaks well of it. It has a sedative effect relieving the pain, nausea and vomiting. It should be used to the physiological limit.

In closing the section on the functional disturbances of the gastrointestinal tract, the writer cannot refrain from sounding a note of caution—that many of these conditions are encountered in persons in whom a neurosis undoubtedly occupies the center of the stage, yet in the final analysis there may be in the background a definite disease picture induced from one cause or another, marked by the neurosis.

It was not so long ago, before we understood the symptomatology as well as we do today, that cases of chronic appendicitis without local symptoms, were frequently put in the neurasthenic class. A subsequent acute exacerbation and removal of the offending organ cleared up the “neurasthenia.” On the other hand, there is evidence to show that the effects of emotional states on bodily functions, are often forerunners of actual disease. To take one example, the frequency of the association of ulcer with vagotonia must impress one as being more than a coincidence.

(j) CONSTIPATION.

Constipation is a condition that may arise from many concurrent causes. There are various forms. It may be defined as a state in which the bowel fails to evacuate itself in a cycle of at least 48 hours. The actual time varies in different people within prescribed limits, such variations being compatible with normalcy and health.

Food taken on an empty stomach reaches the cæcum on an average in four hours, the hepatic flexure in six hours, the splenic flexure in nine hours and the iliac portion of the descending colon in eleven hours. From there onward, there is a marked retardation in the forward movement, another hour or two being consumed before the mass finally arrives at the recto-sigmoidal junction.

The recto-sigmoidal junction owing to its anatomical construction offers a definite obstruction to the onward march, nothing entering the sigmoid and rectum, which is normally empty, until just before defecation, when,

with increased peristalsis, its muscular fibres relax and permit the bowel, from the splenic flexure downward, to empty.

Although in the majority of non-constipated persons, the bowels move on an average of once or twice in twenty-four hours, there are exceptions to this rule, for in the asthenic and sthenic individual the rate is respectively slower and faster.

Aside from so-called constitutional constipation, in which all or several members of a family through one or more generations are afflicted, the condition is acquired, either as the result of improper colon hygiene or disease.

Many cases date back to early youth, where the cathartic was substituted for a proper diet and regular toilet habits. Constipation, for practical purposes, can be divided into two varieties, the atonic and the spastic; a third form would be dyschezia, in which the fæces pass uninterruptedly into the rectum, where they are retained owing to the lack of the normal rectal reflexes.

To intelligently treat constipation we must know in detail the habits of the individual. A useful practice is to have the patient recount a typical day, giving at some length his usual routine, the amount of sleep, hours of work, character of work, sedentary or otherwise, type of meals he eats, the regularity with which he takes them, the amount of exercise, etc. By so doing many points can be ascertained that are helpful both in the adjustment of diet and in advising the general hygiene.

Unsuitable diets, lack of exercise, fatigue, anxiety, and worry are all factors in inhibitory peristaltic activity. There seems to be a widely prevailing feeling, especially in America, that unless the bowels move daily and often twice, the system is being poisoned. Again there are persons who suffer acute mental anguish from the idea that their bowels are not moving sufficiently. I have seen numerous instances where people have kept up a continuous cathartic habit and reduced their diet simply from the fear that their bowels were not moving sufficiently or at frequent enough intervals; and yet who, on examination under the fluoroscope, were found to have a normal bowel function.

The general physical condition plays an important part. Anæmia must receive its proper treatment. Where malnutrition exists its cause must be sought for, and if possible corrected. Chronic fatigue and emotional states are patent inhibitory factors in constipation. One frequently sees examples, especially among women, who either through domestic cares and anxieties or from habitual social overindulgence become nervously and physically exhausted. It is often useless to try to correct faulty bowel action in such cases until the nervous equilibrium has been restored and there has been an opportunity of taking sufficient physical rest. In many of these patients a systematic rest with a rational diet will bring about a return of normal bowel activity.

A large majority of constipated subjects have what may be called simple uncomplicated constipation. For after a painstaking examination including x-rays and fæcal analysis, one is unable to find anything abnormal.

Many of these people have had the costive habits of many years standing. The faecal mass, as a rule, descends into the rectum, but the call to defecate is usually neglected until the rectal reflex becomes so blunted that all normal desire ceases.

One sees among those who commute many examples of this type due to their anxiety to catch the train. Also many women, either through false modesty, apathy, or from the oppressing nature of their domestic duties, suppress the call to defecate, until the reflex is lost. With the onset of constipation purgatives and enemas are resorted to, thus further maintaining the vicious cycle. Later fears and apprehensions—fears that the bowels will not move—further reflexly inhibit colonic function.

Treatment.—Habit.—When once the diagnosis of constipation has been made and its nature determined, the first step is to give the patient the firm assurance that with his coöperation the bowels can be made to move if given a chance. He is to be instructed in colonic hygiene, the necessity of regular habits, the importance of going regularly to the toilet after breakfast. A suitable posture must be assumed, with the knees raised by a support or footstool, simulating the normal squatting posture. Sufficient time to completely accomplish the act must be allowed, and at the same time the mind should not be diverted by reading a newspaper. A consistent muscular effort must be made but excessive straining is to be avoided. The colonic reflex can be further stimulated by bending the body forward and making firm pressure under the costal angle with both hands. If there is no result assure the patient that it is of no importance, that a daily bowel action is not necessary and if he skips even three or four days, it is not a vital matter. At the end of this time if there is no result, an enema should be given. Such cases are often helped by the dilatation of the anal sphincter or by the passage of a proctoscope. These simple uncomplicated cases are the ones on which Christian Science and mental healing work so successfully. They receive full assurance that all will be well and to leave nature alone, and in most instances the results are all that could be desired.

DIET.—Errors of diet are among the commonest causes of constipation. Either the diet is insufficient in quantity or it is lacking in proper quality. This is particularly true among neurasthenics, who, from lack of appetite and through some preconceived idea, choose articles that they believe to be easily digested, or which appeal to their bizarre appetites.

A laxative diet is one which increases peristalsis largely by stimulating the muscular coat. This is brought about in two ways—one by increasing the bulk of food residue, and the second through the chemical properties of the food. Atonic and relaxed muscular states of the bowel call for a diet rich in cellular residue. This in general means an increase in vegetable foods containing varying amounts of cellulose, such as spinach, peas, asparagus, onions, tomatoes, celery, lettuce, cabbage, string-beans and Brussels sprouts. The value of some of these is not always in the ratio of their cellular residue, for some of their laxative properties are derived from the stimulating alkaline or organic salts which they contain. Foods

that are particularly rich in cellulose are rye, gluten and whole wheat bread. Bran contains about 20 per cent. of coarse fibre and is a very useful adjunct. It should be made up into bran buns or added directly to such foods as cereal, apple sauce, or baked potatoes. Radman's cellulose bread contains 3 per cent. of cellulose, and Wicker's cellulose bread contains true beechwood sawdust, and is very palatable.

Lohrich found that the tender cellulose such as is contained in most vegetables is normally digested in the intestine to the extent of 52 per cent., a much higher figure than was formerly supposed. In constipated subjects these figures would even run as high as 80 per cent. or over, suggesting that, in spite of a material increase in the vegetable diets, the proportion of residue is frequently not sufficient to give adequate stimulation to the colon.

Adolph Schmidt suggested, as a means of increasing faecal residue, the use of agar. Agar is a species of Japanese sea alga, a hemi-cellulose unaffected by the digestive juices. It is for the most part unabsorbed in the bowel and affords a very satisfactory means of adding bulk. It is sold under the trade name of "agar-agar."

Regulin is agar-agar impregnated with cascara, the amount of cascara being approximately a grain to the ounce. It has a more laxative effect than agar, but its taste is not so agreeable. It is administered with some food, such as cereal, apple sauce or mashed potatoes, and should be given in fairly large quantities—2 to 3 teaspoonfuls a day, reducing the amount as the bowel activity improves. Certain persons cannot use agar as it gives rise to indigestion.

Most fruits, except bananas, have laxative properties owing to their chemical composition. They are useful in the spasm types of constipation. Sugars, especially milk sugar and levulose which are easily broken up, undergo fermentation and thus stimulate intestinal peristalsis. The chemical excitants to bowel peristalsis are especially desirable in the spasm form of constipation. Stewed fruits are more effective than the raw from the additional amount of sugar they contain. Of interest in connection with the laxative properties of fruits are the grape cures. These cures have been practised in certain continental health centers, and consist in eating daily large quantities of grapes—10 to 12 pounds—in addition to a general diet with a slightly increased protein intake. The day is started by eating one or two pounds of grapes before breakfast while the remaining amount is worked in either with meals, between meals, or at bedtime.

Among laxative foodstuffs must be mentioned the sour milks, such as buttermilk, kefir, and yoghurt, which owe their laxative properties to the presence of lactic acid. Fats in the form of butter, oil and cream are stimulants to intestinal activity through their fatty acids.

There is no contraindication to the moderate use of the lighter meats as fish, chicken, lamb, Virginia ham and to the sparing use of eggs; the arrangement of the diet depends on the type of constipation.

There are certain requisites to the successful treatment of constipation:

(1) The intelligent coöperation of the patient, his ability to carry out the dietetic direction, and willingness to devote sufficient time to the care of his general health. He must take sufficient time to establish regular toilet habits, going each morning after breakfast, when the gastro-iliac reflex is strongest; and should pay due attention to requisite rest, recreation and exercise.

At the onset of treatment it is well to clear the rectum and sigmoid with a normal saline enema, to be done with the patient lying down; the position he assumes, whether it is on his back or sides, is unimportant, so long as it is horizontal. The rectal tube is inserted from four to five inches; it is futile to try to force it further, for radiographic observations have shown that it is practically impossible to pass the recto-pelvic fold, the tube curling on itself. It is neither necessary nor desirable as a rule to use more than a pint and a half of water; larger amounts overdistend the rectum. The water, allowed to flow in slowly from an elevation of not over eighteen inches, will excite but little muscular spasm and will pass up to the cæcum; its final expulsion will dislodge material along the entire colon.

Smaller amounts of fluid injected with more force, as with a syringe or from a greater elevation will excite more violent spasms and will cause expulsion of the bowel contents from the descending colon downward.

Medicated enemas as a rule are not necessary, save in such cases, where from prolonged retention the fæces have become hard and the large mass firmly impacted. Under these circumstances soap suds, glycerine and ox-gall, or an oil enema may be used.

In dyschezia, where the fæces are retained in the rectum and in consequence become hard from the absorption of water, the injection of olive oil, cotton-seed oil or liquid paraffin will lubricate and soften the fæces permitting an easier expulsion. The former two oils have a stimulating effect on the colonic mucosa as well as being lubricants.

The habitual use of glycerine in the form of enema or suppository should be discouraged, as its irritant properties may ultimately produce a catarrhal proctitis.

At the onset a full explanation should be made to the patient as to the general plan of procedure and the importance of a strict adherence to details. This may be summarized somewhat as follows:

- (1) The diet.
- (2) Instruction in the necessity of regular toilet habits.
- (3) A firm assurance that skipping a defecation on one or more days is of no importance and that the bowels will ultimately move.
- (4) At the start it is generally necessary to use some form of laxative, this preferably mineral oil; it is well to begin with comparatively large doses 45 to 60 cc. ($1\frac{1}{2}$ to 2 ounces) taken either in one dose or divided doses after meals. The amount can be reduced, as circumstances permit; where there is deficient peristaltic action the addition of agar-agar or regulin to the diet is indicated.

Water should be taken in fairly liberal amounts, as it aids in keeping

the fæces moist, five to seven glasses per day is a fair average; large amounts tend to overdistend the stomach and have no advantage.

A glass of cool water should be sipped on arising, cold water is more stimulating to peristalsis than hot.

If there is no bowel action for a period of two days an enema is given. As a rule I prefer the injection of liquid paraffin in the rectum at bedtime to be retained over night and this is usually sufficient to soften the fæces and allow their expulsion on the following morning. If there is much intestinal gas, this procedure is not always practical; in which case a simple saline or soap sud enema can be used after the regular morning attempt has been made.

Drugs.—The majority of cases of constipation can be treated without any drugs, provided the treatment is instituted at a reasonably early time, and it is often surprising to find cases of long standing that yield to comparatively simple measures.

In acute febrile conditions a purgative is usually beneficial in the beginning; chlorosis is often aggravated by constipation and a mild laxative is indicated.

In such chronic conditions as diabetes, nephritis, and in constipation among the insane and in old persons purgatives should be given regularly; also in inoperable cancer.

Certain severe cases of constipation in the beginning require some laxative, but this should be withdrawn as early as possible; also every effort should be made to ascertain that these cases actually require it; many persons have been so long accustomed to the drug habit that they are unable to convince themselves that it is not essential.

Where purgatives are used they should be so administered that they act as nearly as possible like nature, giving one stool per day; violent purgatives that hurry the food through the intestines and deprive the patient of water, nutriment and salts are to be avoided. Without going into exhaustive detail certain general indications may be made regarding the principal drugs used.

The anthracene purgatives are of vegetable origin and owe their purgative properties to irritation of the intestinal mucous membrane, which causes a local reflex in Auerbach's plexus. They are aloes, senna, cascara sagrada and rhubarb. Closely related to this group is the synthesized purgative phenolphthalein.

Aloes and senna act only on the large intestine; rhubarb contains astringents and tannic acid and has a constipating after effect which renders it unsuitable for regular use. Cascara acts on the small intestine and colon and in this respect has a distinct disadvantage to aloes and senna.

Both aloes and senna are useful where a laxative action is required, but will cause griping unless administered with belladonna; it is questionable whether *nux vomica* or its alkaloid, strychnine, enhance their laxative values. Aloes is an exceedingly reliable purgative and can often be used for years without producing irritation or requiring an increase in the dose.

Senna has the disadvantage of often producing nausea and griping, due to a resinuous constituent which is insoluble in cold water. A useful way of administration is to allow the senna pods to soak four to five hours in cold water; the water is then drunk at bedtime; thus the dose may be regulated and gradually reduced; both aloes and senna are of service in the constipation of old age.

Castor oil is non-irritant to the stomach; it causes a rapid transit of fæces from the cæcum to the rectum, the entire colon being emptied by one or more powerful contractions; it is one of the most valuable purgatives for occasional use.

Saline purgatives.—The commonly accepted theory as to the action of salines, that they operate by increasing the watery contents of the bowel, would appear erroneous. Investigation has shown that salines are absorbed from the small intestine and that they act through the blood and nerve supply of the colon. Martinez has injected 0.25 gram in 1 cc. of water in the buttocks daily for six to ten days and found that severe cases of constipation generally yielded; he advocates this method of treatment, claiming that with the proper adjustment of diet, he was able to cure stubborn cases of constipation.

The saline purgatives if given in sufficient dose will empty the entire colon; they should be given in the morning, preferably half an hour before breakfast.

Soper has had good results in recto-sigmoid spasm by the application of a saturated solution of magnesium sulphate. He applied this directly to the spastic area with a cotton applicator through a recto-sigmoidoscope, and the treatment is repeated every two or three days until the spasm finally relaxes. Soper regards the direct application of magnesium sulphate to this area as a specific in overcoming hypertonicity of the circular muscle fibres. I have employed this treatment in a number of cases and have been much gratified with the results.

The saline purgatives operate solely on the large intestine; they act well, especially in the types of spastic constipation and in the constipation of those who habitually overeat and under exercise.

The mineral waters are best taken at the springs themselves, where freedom from business cares and domestic worries combined with baths and the regular drinking of the aperient water, often has a beneficial effect on constipation.

Mercury in any form plays no part in the treatment of chronic constipation; it is far too irritating to the intestinal mucous membrane.

Nux vomica and *strychnine* are used in constipation where there is depression of the central and peripheral nervous systems. Our knowledge of the action of strychnine on the intestines is based largely on clinical evidence; my personal impression is that its usefulness is more theoretical than real, as far as any direct stimulating effect on the intestine is concerned.

Belladonna and *atropine* have a sedative action in the spasms of colic and in irregular actions of the bowels. They relieve the pain and cause the

lumen of the bowel to open (Hurst). They are of use in the spastic forms of constipation, lead poisoning, and muco-membranous colitis. Belladonna is usually combined with the vegetable purgatives to overcome this gripping effect.

In the reflex forms of constipation, which are the result of abdominal and pelvic diseases, *opium* is of inestimable value; it not only quiets the pain, but it relaxes the spasm, and facilitates the opening of the bowels.

It is considered of less value in the spastic forms of constipation than belladonna owing to its constipating after effect, aside from its habit-forming possibilities.

Hormones.—Investigations by Zuelzer and others have shown that the stomach and intestines elaborate a substance, that is carried in the blood and stored in the spleen. This substance has the power of stimulating intestinal peristalsis, and probably is a factor in the maintenance of normal peristaltic activity.

Zuelzer made use of this discovery and prepared a splenic extract which was marketed under the trade mark of "Hormonal." Hormonal, injected into the blood, caused increased intestinal peristalsis. Unfortunately Hormonal produced symptoms of an undesirable character, for many cases of collapse and a few deaths were reported after its use. The ill effects were attributed to an albumose. A new preparation has been prepared which is known as "Neo-Hormonal." This is said to be free from objectionable features. It is given by intramuscular injection. There are reports that some of the results have been promising. I have had no experience with either preparation.

Hypo-thyroidal subjects are nearly always constipated. When treating constipation, the characteristics of this condition must be borne in mind and when suspected, call for thyroid gland. This is best given in small doses repeated twice or three times daily. The infundibular part of the pituitary gland has a stimulating effect on intestinal peristalsis, and extracts of the gland have been given with success in intestinal paralysis following surgical operations.

Exercise.—The benefit of regular exercise on the general health is too well known to need detailed mention. The increase of appetite, the maintenance of voluntary muscle tone with the massage of the viscera, through constant change of abdominal pressure, are all preventive measures of constipation.

The forms of exercise that are of the most value are those that bring about changes in the abdominal pressure, such as hill climbing, rowing, and horseback riding. A systematic course of calisthenics can be substituted for those whose work or circumstances do not permit in the indulgence of outdoor sports. I have found the monograph by Muller, entitled "My System," an excellent practical guide for patients to follow. There are separate editions for men and women.

Massage.—Simple massage is an efficacious adjunct in constipation due to loss of intestinal peristalsis and weakness of the abdominal muscles. It

is contraindicated in spastic conditions of the colon. The bladder should be emptied and the knees raised.

Various movements have been advocated, but exceedingly valuable stimulation can be given intestinal peristalsis by a circular stroking movement, beginning at the cæcum and following approximately the course of the colon around toward the sigmoid. This is a simple method and can be carried out by a nurse or member of the family with a little practise.

Auto massage is practised by rolling a cannon-ball around the abdomen following the course of the colon. Balls are now made which can be filled with shot to the desired weight, about four to six pounds. It is a useful method inasmuch as the patient can carry it out for himself.

Heat is indicated in several forms of spastic constipation. It is best applied moist. A flannel compress is wrung out in warm water. This is covered with oil silk and an electrotherm laid on top.

In some cases it should be applied two or three times daily.

DYSCHIZIA.—There remains an exceedingly intractable form of constipation known as dyschezia, in which the recto-sigmoid apparatus has lost its contractile power, resulting from the prolonged retention of fæces in the lower bowel. This may follow ulcer of the anal canal, or it may be due to congenital atony of the parts. In the milder cases, diet, increasing the bulk of fæces with the other measures applicable to atonic constipation, in conjunction with gradual dilatation of the anal sphincter may suffice in mitigating the condition, but in the advanced cases, where all tendency to contracture is lost, so far as permanent relief is concerned, no treatment is of avail. The habitual use of large enemata is necessary to remove the rectal accumulations.

III. DISEASES OF THE LIVER.

J. C. WILSON.

i. Anatomical Anomalies of the Liver.

These may be congenital or acquired. They are, however, of no great clinical interest. The so-called corset liver has importance in the differential diagnosis from new growths involving the pylorus, hepatic flexure of the colon, the right adrenal, dilatation of the gall-bladder, hydronephrosis, cysts of the mesentery, pancreas, right ovary or uterine fibromyoma.

Treatment consists in discarding the restricting corset or belt, substituting straight-front stays and suspending the garments from the shoulders. The artificial lobe, in rare cases attended with pain, has been surgically removed.

ii. Movable Liver.

Corsets which exert downward pressure upon the liver should be discarded. The condition is practically always part of a general visceroptosis, which should receive attention. A proper abdominal supporter or belt

may be worn. The tone of the muscles may be improved by massage and systematic exercises and the general nutrition cared for. Surgical procedures to fix the organ in position have yielded postoperative relief of symptoms, but the late results have not been satisfactory.

iii. Functional Disorders of the Liver.

The symptoms commonly ascribed to functional derangement of the liver under such terms as "biliousness" "torpid" or "inactive" liver, and comprising loss of appetite, flatulence, constipation and clay-colored stools, muddy and subicteroid complexion, *muscæ volitantes*, headache, depression and irritability are commonly due to improper food, insufficient exercise and constipation. That the indigestion caused by these agencies is associated with the formation of an excess of toxic chemical substances beyond the capacity of the detoxicating function of the liver cells is highly probable. The disorder of the liver is therefore under these circumstances not primary but secondary. The condition is much more common in persons of so-called bilious than in those of sanguine or nervous temperament. The treatment consists in a careful regulation of the diet which should be simple in quality, and self-denying as to amount. Rich, thick soups, stews, rich fish such as salmon, much meat, duck, goose, sausages, liver, bacon, sauces, pastry, especially puddings made with suet, should be avoided. Cheese, except in very small quantities, is inadmissible. Condiments and sugar-plums must not be used. Idiosyncrasies are to be considered. Such persons very often cannot take milk, eggs or any form of sea food. Open air exercise as a habit is especially beneficial. Constipation must be avoided. During the presence of symptoms a qualified hunger cure may be practised with advantage, alkaline mineral water, such as Vichy, being taken in small amounts at short intervals and a dose of calomel or an old-fashioned blue pill as a purgative. In the intervals of the attacks, courses of the extract of pancreas called holadin, in association with bile salts (sodium glycocholate and taurocholate), phenolphthalein, sodium succinate, and sodium salicylate in various combinations in capsules may be administered with advantage. A visit to alkaline or sulphur spas as Vichy, Harrowgate, Ems, abroad and White Sulphur, W. Va., Las Vegas, New Mexico or Bedford, Pa., in our own country may be recommended.

iv. Jaundice: Icterus.

This symptom is present in very different morbid conditions, and is of varied significance. It may be (a) obstructive, (b) hæmolytic, or (c) infective, toxic or hæmohepatogenous. The two latter forms are covered in subject matter where jaundice appears as a complication.

(a) **Obstructive Jaundice.**—The causes of obstructive jaundice may be arranged in four main categories:

1. The obstruction is within the lumen of the ducts. It may be caused by gall-stone, inspissated bile or mucus, intestinal or other parasites, very rarely by carcinoma.

2. Lesions in the walls of the ducts, inflammatory thickening as in cholangitis; stricture which may be congenital or acquired; new growth benign or malignant; spasm as in emotional jaundice (Meltzer).

3. Pressure upon the ducts from outside their walls by enlarged glands, tumors and adhesions, and cicatrization.

4. Torsion and angulation of the ducts.

Catarrhal Jaundice.—This benign form of jaundice is usually seen in early life and is rare after the third decade. It is due to swelling and mucus in the intestinal portion of the common duct. It may occur in later life in the early stages of malignant disease of the liver. Aside from the jaundice, the symptoms are sometimes insignificant and the first intimation of the malady comes from friends of the patient who notice the yellow conjunctiva or skin. More commonly the gastro-intestinal symptoms are well marked and jaundice rapidly develops.

Treatment consists in rest in bed and the withholding of solid food for a few days. In fact, total abstinence from food and the free use of water with sodium bicarbonate or Vichy water in small but frequently repeated doses, whey, barley water and the like is judicious. Small doses of deodorized tincture of opium, or dionin in essence of pepsin may be needed to relieve nausea or vomiting. Hot compresses over the epigastrium may aid in relieving the nausea and tendency to vomit in severe cases. Diarrhœa is usually not troublesome, and when constipation occurs it may be relieved by enemata. When the desire for food occurs, the diet may be resumed in the form of peptonized milk, junket, custards, broth, milk toast, rice pudding. In a few days the patient may begin to take ordinary light food. Sodium salicylate or succinate or hexamethylenamine should be given. The bowels should at this stage be kept open by magnesia or a saline. Large enemata of saline solution have been employed to stimulate the contraction of the gall-bladder. The pruritus may be relieved by lotions containing menthol, thymol, phenol, boric acid and similar substances. *Nux vomica* may be given during convalescence.

Duodenal aspiration has been practised with the view of removing the mucous plug from the orifice of the common duct.

Icterus Neonatorum.—Physiological Icterus.—The condition is never fatal and there are no symptoms except the jaundice. The treatment is therefore expectant. The baby should have water in abundance and minute doses of calomel may be given unless the bowels are sufficiently moved.

The differential diagnosis from the grave conditions in the new-born which are attended with jaundice is very important, since in all these, with the exception of syphilis, the prognosis is practically without hope. The jaundice comes on later and the symptoms are those of profound toxæmia. Death in convulsions is common.

v. Acute Yellow Atrophy of the Liver.

Malignant Jaundice—Icterus Gravis.

Icterus gravis is a general term applied to severe conditions characterized by autolytic changes in the liver cells and consequent rapid insufficiency of the organ. It includes acute yellow atrophy, phosphorus poisoning, yellow fever and the severer forms of diffuse hepatitis due to infection by various pathogenic organisms, all of which are usually attended by very intense jaundice. Acute yellow atrophy though differing in some respects, as in the case of phosphorus poisoning, in which the liver is enlarged, may be regarded as the type of these conditions.

The prophylaxis against acute yellow atrophy consists in the avoidance of conditions that impair the resistance of the liver and increase hepatic disorders already developed. Since changes closely simulating acute yellow atrophy sometimes follow the intravenous injection of arsphenamin, any disease of the liver constitutes a contraindication for this treatment in syphilis. The mild jaundice of early syphilis, which is usually transient, constitutes an indication for the treatment by mercury. Acute alcoholism has been followed by acute atrophy and persons suffering from any form of hepatic disease should avoid excesses. Chloroform has an autolytic action and should not be used as an anæsthetic in parturient women who are jaundiced or manifest other signs of hepatic disease. Chloral and chloretone are also contraindicated. Catarrhal jaundice when severe and especially when attended with drowsiness must be promptly treated with purgatives, intestinal antiseptics, alkalies, and diuretics with the view of correcting toxæmia and counteracting the tendency to acidosis.

Causal treatment is of little avail when the symptoms are well established. There are subacute cases in previously healthy young adults; but they are infrequent. Plenty of water with sugar should be given; the restlessness, nausea and vomiting may be relieved by morphia hypodermically; acidosis by sodium bicarbonate by the mouth, rectum, subcutaneously or intravenously. Colonic lavage should be employed and minute doses of calomel are recommended.

vi. Affections of the Blood Vessels of the Liver.

1. Hyperæmia.—There are, generally speaking, two forms, the active and the passive.

(a) **ACTIVE HYPERÆMIA; ACUTE CONGESTION OF THE LIVER.**—This condition may be the early manifestation of an acute hepatitis. From the clinical standpoint the degree at which congestion ends and inflammation begins cannot be determined. It is convenient to consider them separately.

The Prophylaxis.—This consists in a reasonable mode of living, especially in the matter of eating and drinking. Alcohol, condiments and rich foods favor the development of biliary congestion. Sedentary habits and

constipation act in the same way. Sudden exposure to surface chilling, especially when fatigued, may precipitate the attack.

The Causal Treatment.—Rest in bed, complete abstinence from food, and mercurial purgation are fundamentals. The pain may be treated by leeches, wet cups and hot compresses frequently renewed. The withdrawal of blood by a trocar passed into the substance of the liver has been practised, but is attended with the risk of troublesome hemorrhage and is not to be recommended. The free use of ammonium chloride in doses of 1 gram (15 grains) is advocated. Upon the subsidence of acute symptoms a gradual return to a wholesome diet should be made. This form of hepatic congestion is much more common in men. Golf and horseback riding should be recommended as a preventive to patients of either sex.

(b) **PASSIVE CONGESTION; CHRONIC VENOUS ENGORGEMENT OF THE LIVER.**—This condition is a result of any disease in which the intravascular pressure is transferred from the arterial to the venous side of the circulation. It may develop rapidly in the cardiac insufficiency of acute infections as diphtheria or pneumonia or in paroxysmal tachycardia or auricular fibrillation or in the *stadium ultimum* of mitral disease. Adherent pericardium, pulmonary emphysema, and stenosis or occlusion of the hepatic veins are also causes of hepatic congestion. As a rule, the congestion gradually develops and from time to time the size of the liver varies greatly. These fluctuations in size are a measure of the degree of cardiac insufficiency. In the great majority of the cases the heart symptoms dominate the clinical picture, but cases occur in which the hepatic symptoms prevail. These are in addition to the enlargement of the organ, tenderness, moderate jaundice, dyspepsia and ascites.

The treatment which is mostly concerned with the heart, is considered under the headings of the diseases in which chronic congestion of the liver occurs. Hot compresses and the application of leeches are indicated when pain is distressing.

2. Diseases of the Portal Vein.—Thrombosis; Pylethrombosis; Pylephlebitis; Adhesion.—Treatment in the acute cases is unsatisfactory; in chronic cases the ascites and hæmatemeses may be treated like similar conditions in cirrhosis of the liver. Upon the occurrence of bloody stools and symptoms suggestive of intestinal obstruction, an exploratory laparotomy may be thought of; but no operation is useful. Among those mentioned are splenectomy and the Talma-Morrison operation for vascular adhesions, but free anastomoses already exist. The administration of the citrates to prevent further clotting, recommended on theoretical grounds, has proved useless.

3. Diseases of the Hepatic Artery.—Aneurism is very rare. A number of cases have been studied during life, but the positive diagnosis has never been made except after laparotomy.

4. Diseases of the Hepatic Veins.—Occlusion may occur by stricture, phlebitis or thrombosis. The symptoms resemble those of thrombosis of the portal vein. No case has been recognized during life. The condition is therefore of pathological rather than of clinical interest.

vii. Inflammation of the Liver.

Acute Non-Suppurative Hepatitis.—There is no clinical method of determining where acute congestion ends and inflammation begins. Perhaps the temperature may be of service in this respect. Some clinicians would draw the line at 100° F. (-37.5° C.), others at 102° F. (-40° C.), but this is arbitrary. The clinical phenomena are much the same as in acute congestion, but much more severe. There is a form due to amœbæ in which the presuppurative stage is of long duration—several weeks or months.

The Prophylaxis.—This is the same as in acute congestion. In a patient suffering from amœbic dysentery, the energetic use of emetin is necessary as a preventive of hepatitis.

The Treatment.—This is symptomatic and comprises the therapeutic measures employed in acute congestion. If amœbæ are found in the stools, emetin bismuth iodide must be given hypodermically, 0.01 gram ($\frac{1}{6}$ grain), once or twice a day for three or four days, and then at longer intervals for a week or more, and in combination with some form of ipecac by the mouth. The poisonous properties of emetin which are exerted upon the heart are not to be overlooked in the dosages.

viii. Suppurative Hepatitis; Abscess of the Liver.

Stress is laid on the abstinence from alcohol and self-denial in the pleasures of the table in countries where amœbic dysentery is endemic, and since dysentery is a water-borne disease the sterilization by boiling of drinking water and that used in washing vegetables that are eaten raw. When dysentery has occurred, its prompt and effective treatment by emetin is a necessary measure of the prevention of hepatic abscess. The occurrences of cases and especially of groups of cases of amœbic dysentery in temperate climates, and in communities otherwise free from it, may be explained by infection from a carrier. Liver abscess may occur under such circumstances.

Treatment.—When abscess formation has taken place, its proper treatment belongs to the domain of surgery. The earlier the presence of pus is recognized and free drainage instituted, the better the outlook for recovery. Emetin should be administered at the same time and may be injected into the abscess cavity.

ix. Cholangitis.

There are two main forms, the suppurative and the chronic catarrhal cholangitis.

1. Suppurative Cholangitis.—The condition is a surgical one.

Prophylaxis.—This consists in the prompt removal of a biliary calculus in the common duct or of a hydatid cyst of the liver. The reëstablishment of biliary drainage may be followed by recovery. This may occur by the escape of the stone; but its removal by operation is the proper course. Abscesses upon the surface of the liver must be evacuated. Hexamethyl-

enamine and sodium salicylate are given with the view of stimulating the flow of bile and disinfecting the passages. Other medication should be supporting and pain relieving.

2. Chronic Catarrhal Cholangitis.—There are two forms; one which occurs as a sequel of the acute suppurative variety and is always associated with obstruction of the common duct, and a second or non-calculus form which occurs in the hypertrophic biliary cirrhosis of Hanot, in poisons reaching the liver by way of the blood, in chronic venous congestion, portal cirrhosis or malignant disease. The outlook is in the highest degree unfavorable. Attempts may be made to disinfect the bile ducts by hexamethylenamine and to stimulate the flow by sodium salicylate and clear out the intestine by mercurial purgation.

x. Chronic Interstitial Hepatitis.

Portal Cirrhosis.—Laennec's cirrhosis.

Biliary Cirrhosis.—Hanot's hypertrophic cirrhosis.

(a) Treatment of Portal Cirrhosis. General Prophylaxis.—The following facts in regard to the occurrence and prevalence of hepatic cirrhosis have important bearings upon the prevention of the disease:

Alcoholism is prominent in the anamnesis. Habitual toppers suffer more commonly than those who commit occasional excesses. Those occupations which involve the handling and distribution of alcohol are attended with the danger of cirrhosis. It is thought that ethyl alcohol does not act directly but by inducing intestinal catarrh and favoring the production of toxins which act upon the liver cells or that the presence of methyl alcohol as an adulterant may act in the same way. Animal experiments have shown that alcohol tends to produce fatty rather than fibrotic changes in the liver. Stimulating articles of food and various condiments and spices taken habitually and in excess may cause cirrhosis. The frequency of cirrhosis in Egypt among Mohammedans has been ascribed to poisons elaborated by intestinal parasites as *uncinaria* and *bilharzia hæmatobia*. These people do not use alcohol.

Individual Prophylaxis.—At a period when the indefinite manifestations of intestinal catarrh appear in an individual exposed to the causes of cirrhosis and are attended with liver symptoms, the correction of habitual errors in eating and drinking is of the utmost importance. The diet should be restricted in amount and limited to the blandest natural foods of which milk should form the chief constituent. Constipation should be corrected by salines or mineral oils. Tinctures, spirits and other alcoholic preparations of drugs must be interdicted. If there is a history of syphilis or a positive Wassermann reaction, a course of mercurial and iodine treatment is to be preferred to the modern use of arsphenamin.

Treatment.—The foregoing measures of prevention amount also to rational treatment when the case comes under observation at a later period, the object in view being to prevent if possible further progress in the morbid

process. Splenectomy may be considered when there is reason to believe that the cirrhosis is due to poisons or bacteria in the blood from the splenic vein. Hæmatemesis may be the first symptom to suggest cirrhosis. The amount of blood lost may be large and death frequently results. The bleeding may be from a varix in the œsophagus just above the cardia, but may be from other sources, chiefly varices in the mucous membrane of the stomach or gastric and duodenal ulcers. The treatment of this condition consists in complete rest in bed and total abstinence from food and fluids of every kind by the mouth. The mouth should be rinsed or washed out at short intervals and enemata of normal salt solution administered, or the fluid may be given by the Murphy drip. Calcium lactate can be given in this way and an occasional enema of predigested milk or egg.

Ascites occurs late, and in most instances marks the beginning of the terminal stage. The discomfort resulting from large effusions is chiefly mechanical, pain from distention, shortness of breath, cardiac palpitation, constipation and oliguria. In the presence of large effusion paracentesis should be promptly performed. As the fluid rapidly reaccumulates, the operation must be repeated at intervals. Meanwhile the iodides may be given. The ascites of cirrhosis does not yield to diuretics, purgation or a salt-free diet. Good reports have followed the employment of auto-serotherapy and surgical treatment designed to bring about vascular peritoneal adhesions between the liver and omentum. Omentopexy and the Talma-Morrison operation have had a measure of success.

The treatment of portal cirrhosis is symptomatic. Medicine has no resource by which to increase the hyperplasia of the liver cells or limit the fibrosis which follows their degeneration and destruction.

(b) **Treatment of Biliary Cirrhosis.**—The patient should lead a quiet life, under favorable hygiene conditions, and with regulated exercise in the open air. During the crises he should remain in bed. Overexertion and exposure to cold and wet are liable to precipitate a crisis. The digestion is usually good and the diet should be simple and nourishing. Highly spiced and stimulating articles of food are to be avoided; alcohol strictly prohibited. During the crisis a limited milk diet, or preferably, for a day or two, total abstinence from food is desirable. Saline laxatives should be habitually used and a "cure" at Carlsbad, Homburg, Vichy or Harrowgate abroad, or Bedford Springs, Penna., or the White Sulphur Springs, W. Va., in our own country may be recommended early. Of drugs, calomel in very small doses in occasional courses of a few weeks has the sanction of experience. When symptomatic treatment has failed, the operation of draining the gall bladder has been performed with good results.

xi. Fatty Liver.

This term includes fatty infiltration and fatty degeneration. Infiltration or excessive accumulation of fat cells occurs in overfeeding, especially when associated with want of exercise, obesity, various conditions attended

with deficient oxidation, and sometimes in the latter months of pregnancy. Fatty degeneration is caused by chronic poisoning by alcohol, chloroform, iodoform, arsenic, the mineral acids. It may be due also to the toxæmia of tuberculosis or intestinal infections. The fatty liver of advanced pulmonary tuberculosis is the result of deficient oxygenation and toxæmia, and reaches a high grade after overfeeding and when large quantities of cod liver oil have been taken.

Treatment.—Fatty liver is a secondary pathological condition, and the treatment of the accumulation form is that of the primary disease as obesity, alcoholism, acidosis. The degenerative form is more difficult to manage, and the recognition of the cause and its removal constitute the first steps in the attempt.

xii. Inflammation of the Gall Bladder; Cholecystitis.

Acute Cholecystitis.—The various forms of acute cholecystitis represent different stages of a progressive pathological series passing from the mildest catarrhal to the most intense phlegmonous inflammation. Acute non-suppurative cholecystitis may occur in the course of the chronic catarrhal form or as an outbreak in the chronic form in which gall-stones are present.

Prophylaxis.—The measures of prevention may be inferred from the considerations of the following factors in the etiology: Accumulation and stagnation of bile in the gall-bladder in consequence of sedentary habits, long intervals between meals, heavy eating, abdominal distention from any cause, a calculus or calculi in the gall-bladder, which may have caused a previous attack, a blow upon the side or other traumatism which impairs the resisting power of the gall-bladder against infecting bacteria. The infection may be by way of the blood and be general as pneumonia, influenza, various septic and pyæmic conditions, or focal especially from the tonsils or appendix. Infection of the gall-bladder is not uncommon in enteric fever both directly from the blood or indirectly from the intestinal lesions.

Treatment.—Rest in bed is necessary on account of the pain and tenderness caused by the extension of the inflammation to the peritoneum investing the gall-bladder. The knees should be flexed. Relief may follow the application of hot compresses frequently renewed. The hypodermic injection of morphia is necessary to relieve colic and secure quietude. The bowels should be opened by a mercurial purge. During the acute stage, food should be withheld, though in the absence of vomiting, water or Vichy water in small quantities may be given at intervals. Measures directed against the infectious cause of the inflammation are the administration of sodium salicylate to stimulate the flow of bile; of hexamethylenamine or methylene blue, as bactericides; and the draining of the common duct and gall-bladder after the relaxation of the sphincter at the papilla by a solution of magnesium sulphate by means of a duodenal tube (method of Lyon). If these measures fail to afford relief, the gall-bladder should be

drained by surgical means, a procedure fully warranted by the frequency with which this type of cholecystitis is associated with the presence of one or more calculi previously latent.

Suppurative Cholecystitis.—This constitutes an advanced stage of the inflammation, and may speedily develop into a terminal phlegmonous or gangrenous form. It therefore demands immediately surgical operation—drainage and cholecystectomy.

Infrequently the suppurative inflammation takes the form of a chronic empyæma of the gall-bladder, a surgical affection requiring drainage.

Chronic Cholecystitis.—A later phase of catarrhal cholecystitis usually caused by cholelithiasis. The general health is commonly impaired, the symptoms being those due to focal infection—gastric, arthritic, myocardial, and sometimes endocardial of the malignant type.

Prophylaxis.—Many cases improve under medical treatment, but the most serious manifestations of this form of gall-bladder disease are prevented by surgical treatment—drainage or cholecystectomy.

Treatment.—The medical treatment is that above outlined for flushing and disinfecting the gall-bladder. The diet should be carefully regulated, fats and eggs in particular being avoided.

xiii. Cholelithiasis: Gall-Stone Disease.

Every clinician knows that there are cases in which biliary calculi are present in the gall-bladder without giving rise to recognizable symptoms. There are, however, many cases in which latency is not complete. The symptoms are marked or referred to other organs. Most commonly the stomach is incriminated, a sensation of epigastric weight or fulness coming on some little time after eating, which is relieved by belching or in some cases by vomiting, and is especially experienced after eating greasy food. Heartburn is a common symptom and flatulence, dull epigastric pain, some tenderness in the pyloric area are suggestive of gastric or duodenal ulcer; but the symptoms are not definite and the diagnosis of gastralgia, gastritis or hyperchlorhydria is frequently made. When there is recurring pain radiating to the right shoulder and extending down the arm or referred pain in the back, the diagnosis of gall-bladder disease becomes probable and may be settled by röntgenographic studies.

Biliary Colic.—This term is more comprehensive than gall-stone colic and the condition may arise independently of a calculus or inspissated bile. Other causal factors are cholecystitis, traction of an ectopic kidney upon the bile ducts, a tabetic crisis, and in some cases hysteria. The most common cause, however, is the irritation of the muscular coats of the bile ducts and gall-bladder by a gall-stone. The pain is, as a rule, sudden in onset and abrupt in ending; in other cases it is continuous and dull, with recurrent paroxysms. It is said to be the most agonizing pain to which human beings are liable.

Treatment.—This is symptomatic and consists in the hypodermic injection of morphia and atropin together with chloroform inhalation while awaiting the anodyne effects of the injection. Hot baths, hot compresses, an ice-bag are recommended, and various sedatives and antispasmodics; but morphia constitutes our most effective means of relief. Recurrent attacks of gall-stone colic suggest surgery as the means of radical cure.

Prophylaxis.—There is no such thing as a general prophylaxis against gall-stone disease. In persons who are obese, given to the pleasures of the table, of sedentary habits, those who suffer from focal infection in the tonsils, pyorrhea alveolaris, and those in whom symptoms indicating chronic gastric diseases, of irregular type and not responding to appropriate treatment, may be due to the presence of a latent biliary calculus, preventive measures may be employed. Those who are of bilious temperament or who have already suffered from symptoms due to functional or infective disorders of the liver should also be put upon their guard as to the danger of later biliary diseases. There is every reason for the employment of such measures after the first attack, and in the intervals of subsequent attacks of gall-stone colic.

Individual Prophylaxis.—The details depend upon the etiological factors.

General Personal Hygiene.—Out of doors exercise, regular habits of bathing, long hours of sleep, warm but light clothing, a daily evacuation of the bowels are important. Scrupulous care of the teeth and mouth and immediate attention to catarrhal affections of the nose, throat and tonsils must be observed.

The Diet.—The great majority of gall-stones are chiefly composed of cholesterin. Articles of food rich in this substance should be taken in limited amounts or wholly avoided. The list includes eggs, fats, the parenchymatous viscera as liver, kidneys, sweetbreads, rich fatty meats and fish especially when fried, peas and beans. Game and fat poultry such as ducks and geese are also to be taken very sparingly. The foods unobjectionable from the standpoint of cholesterin-content are the lean part of roast or broiled meat, chicken, cereals, vegetables, salads and fruits. Butter and cream should be taken sparingly, but skimmed milk may be freely used. Water in abundance is desirable.

Gastro-intestinal catarrh plays an important rôle in the etiology of cholelithiasis. Simple living, a carefully arranged dietary, regularity in meals, thorough mastication, attention to the function of defecation, and appropriate treatment for indigestion are important. The fact that such conditions fail to respond to proper management, being due to a so-called latent cholelithiasis, is not to be overlooked.

Bile Stasis.—This important cause of gall-stone formation may be prevented by systematic exercises which increase the contractions of the diaphragm. Habitual deep respiration is useful in this respect. Corsets and heavy skirts which hinder deep inspiration should not be worn. Enter-optosis should be relieved so far as possible by an especially adjusted belt

and the abdominal muscles developed by massage, the gall-bladder being avoided. Very violent exercises and the jolting caused by riding over rough roads are liable to bring on attacks of colic. The tendency to stagnation of bile in the gall-bladder may be overcome by frequent eating, and the free drinking of hot water or the various alkaline and sulphur waters, as those of Vichy, Carlsbad and Saratoga. These should be taken when the stomach is empty, especially on rising. Among drugs, sodium salicylate, sodium succinate and the bile salts are credited with the power of stimulating the function of the liver in secreting bile.

The paramount indication is inflammation of the gall-bladder and bile ducts. In the absence of inflammation new calculi are not likely to be formed and in normal bile flowing through a healthy gall-bladder an existing calculus may be dissolved. The foregoing measures of prophylaxis constitute also important measures of treatment. Hexamethylenamine in combination with sodium salicylate in connection with the general plan of management outlined above are available elements of medical treatment. Surgical treatment is, in view of the suffering from repeated attacks of colic, the risk of the development of the morphine habit, the danger of chronic invalidism, and the liability of perforative accidents, always to be considered. The judgment of the physician must fix the time when it should be carried into effect.

IV. DISEASES OF THE PANCREAS.

J. C. WILSON.

i. Acute Pancreatic Necrosis.

The subdivision of the cases into hæmorrhagic, gangrenous and suppurative for descriptive purposes is no longer necessary nor quite in accordance with the facts. It is now known that the lesion is not always hæmorrhagic; that true inflammation due to the action of pyogenic organisms is not the primary process; that the disease is essentially a tissue destruction caused by the action of the pancreatic juice upon the structures that secrete it, and the symptoms, the result of the actions of the toxins produced by this autolysis. The term "acute pancreatic necrosis" is appropriate. This nosological correction is further most desirable because in the absence of operation it is frequently impossible to positively determine that the organ involved is the pancreas.

The anamnesis in the severe cases frequently discloses the occurrence of similar but milder attacks and it is thought by some observers that the mild cases are more common than the severe attacks which lead to operation or are discovered at autopsy. These milder cases are usually regarded as biliary colic, but at later operation in severe cases presenting the same symptoms, or at autopsy, the gall bladder and bile-ducts have frequently shown no indications of disease. Mild cases are sometimes found upon operation for gall-stones, the presence of fat necrosis revealing the true

nature of the disease. Mild cases of acute pancreatic necrosis have been occasionally observed as sequels of acute infectious diseases, particularly mumps, Malta fever and scarlet fever.

The Treatment.—Prompt surgery in a suspected case is the proper procedure. By this means the dispersion of the activated pancreatic ferments and the toxic products of necrosis through the tissues, and the resultant general toxæmia may be circumscribed and to some extent controlled. The drainage must be free. As the preparations for operation are being made, morphine may be administered, but it is of diagnostic importance that the pain of acute pancreatic necrosis is but little influenced by this drug. At the same time attempts to control the vomiting should be made by gastric lavage, and colonic flushing used. Neither food nor drink should be given and cathartics are dangerous. Mild cases frequently recover under expectant treatment and without being recognized or suspected. Sudden severe symptoms, such as intense epigastric pain extending to the left of the median line, vomiting, shock, with tenderness and a sense of resistance upon deep palpation, but no spastic rigidity of the abdominal muscles, occurring in an obese person of early middle or later life, or at any age after a severe abdominal injury as the kick of a horse, or the passage of a wagon over the body, justify an operation without delay as it may be the means of saving life.

Pancreatic cysts should be incised and drained. Exploratory puncture is attended with danger. The fistula following drainage may continue to discharge for an indefinite time. An antidiabetic regimen may diminish the discharge but it is not always successful.

There are two forms of chronic interstitial pancreatitis, interlobular and interacinar. The interlobular form is the result of obstruction of the ducts or an ascending infection of the ducts. There is atrophy of the gland with an overgrowth of connective tissue. The islands of Langerhans are not destroyed and diabetes is infrequent. In the interacinar form the islands of Langerhans are degenerated or have undergone sclerotic changes. The overgrowth of connective tissue is between the acini and involves the interlobar septa only to a slight extent. Many cases of this form of chronic pancreatitis are associated with diabetes. The diagnosis of chronic pancreatitis often made by the surgeon in operations involving the gall-bladder and bile ducts and the adjacent parts, and based upon density and enlargement of the head of the organ, is untrustworthy because the pancreas is a gland that under normal conditions varies greatly in size; density of the head does not mean disease, and such cases, recovering after operation upon the adjacent parts, show as a rule no later evidence of pancreatic disease or, dying a few days later, no enlargement or other signs of pathological change in the pancreas.

Deaver regards "the swelling of the head of the pancreas, so frequently found by surgeons, as due to œdema, congestion or an inflammatory exudate that can be absorbed. Chronic pancreatitis characterized by the formation of fibrous tissue is no more curable than is chronic nephritis or cirrhosis of the

liver, while the pancreatic swellings associated with biliary disease subside with the disappearance of the biliary infection."¹

The recent literature justifies the opinion that a majority of the cases of so-called chronic pancreatitis discovered at operations for the relief of persistent jaundice or duodenal ulcer and relieved by cholecystostomy or cholecystectomy may be referred to the group described by Deaver and frequently seen and recognized as such at the Lankenau Hospital. True chronic pancreatitis whether in the interlobular or interacinar form is a wholly different condition. The etiology is not always obvious. Chronic alcoholism, syphilis and tuberculosis are mentioned, but these diseases are very common, while chronic pancreatitis is comparatively rare. Much more frequent and direct causes are cholelithiasis, obstructing the outflow of the pancreatic juice and causing sclerosis; infection with mild attacks of pancreatic necrosis and sclerosis as an outcome; inflammatory invasion from pyloric or duodenal ulcers; the irritation of pancreatic calculi and mechanical occlusion of the ducts by malignant growths which cause fibroid proliferation and atrophy of the glandular structure. The clinical picture is not well defined. The symptoms are due to insufficiency of the pancreatic secretions. When the external secretion is chiefly in default, there is gastrointestinal indigestion on an ordinary diet, with the passage of two or three large unformed stools daily without blood or mucus, such as is frequently present in chronic intestinal disease. These discharges are usually light in color, and when the fat is abundant they may be almost white—steatorrhea. Undigested muscle fibre is seen on microscopical examination. In some instances fragments of muscle tissue may be recognized in the stools on naked eye examination. The constant presence of numbers of undigested muscle fibres in the fæces with a normal time of the passage of food through the intestines is known as creatorrhea (azotorrhea) and is of diagnostic significance.

When the internal secretion is diminished—interacinar chronic pancreatitis—the function of the pancreas which enables the tissues to break down the sugars ingested into simpler substances, is impaired and diabetes results. As the case progresses, there is corresponding pancreatic general atrophy.

Pratt,² whose experimental and clinical work has done much to clear up the obscurities of the subject, concludes that "varying conditions affecting the pancreas, in fact the majority of the diseases of this organ, the different types of so-called pancreatitis, the acute hæmorrhagic, the gangrenous, the suppurative, as well as the fulminating acute toxic necrosis (pancreatic apoplexy), many cases of pancreatic cysts (pseudo-cysts) and chronic sclerosing pancreatitis, in spite of the great difference in their symptomatology and clinical course, and the great difference in their morbid anatomy, are simply different stages and degrees of one disease, for all are immediate or

¹ Am. Jr. Med. Sc. 1912, CXLII, p. 473.

² Oxford Medicine, Vol. III, p. 491.

remote results of the actions of the same causal agent, namely, the activated pancreatic juice."

Treatment.—If the primary cause of the disease can be discovered it should be treated. Prompt arrest may follow surgical measures in cases of persistent jaundice—drainage of the gall-bladder, cholecystostomy, cholecystectomy. If operation followed by prolonged drainage fails, medical measures must be instituted. These consist in the administration of foods adjusted so far as may be to the diminution in the pancreatic secretions and the use of artificially prepared pancreatic substances to replace the ferments. Much depends upon the extent to which the other digestive ferments are able to take up the burden of digestion. Interdependence of function acts as a safety factor and the impairment of physiological efficiency in one organ may be made up by increased activity in others. This fact is especially notable in the digestion of the starches. The powerful diastatic ferment of the pancreas may be absent without great interference with the digestion and absorption of starches. The pancreatic juice is, on the contrary, highly important for the proper digestion and assimilation of fats and proteins.

DIET.—Toasted bread, arrowroot, sago and rice may be permitted in the absence of glycosuria. Sugars, jellies and cereals may be taken freely. Coarse vegetables are to be avoided. Meat should be well cooked and chopped very fine. Gelatine may be taken. Cream and all meat fats are interdicted. Milk may be taken in small quantities.

The pancreatic ferments may be systematically used. They are sometimes very useful. Pancreatin and the preparation of the whole gland known as holadin may be given in full doses one hour after food. The fresh gland eaten as a sandwich or otherwise prepared is very uncertain in its action and patients soon tire of it as a food.

V. DISEASES OF THE PERITONEUM.

HAROLD BARCLAY.

i. Ascites.

The causes of an accumulation of serous fluid in the peritoneal cavity may be either local or general. General conditions giving rise to ascites are usually mechanical, such as heart failure, cirrhosis of the liver and Bright's disease. Local causes are portal obstruction, abdominal tumors and chronic inflammation of the peritoneum.

Treatment.—The general treatment is to be directed at the underlying condition—a decompensated heart calling for cardiac tonics, a syphilitic liver requiring antiluetic treatment. When due to chronic peritonitis no drugs are of any value and the treatment is palliative only.

A dry diet and the restriction of fluids and salt has met with little or no result. When the fluid has collected in an amount sufficient to cause pain, distress, or to embarrass respiration it should be removed by paracen-

tesis. The indications for "tapping" are when the fluid forces the diaphragm upward, giving rise to dyspnoea and cedema of the lungs, a diminished output of urine, or where, as in cirrhosis, there are incipient signs of delirium. Under such circumstances nothing is to be gained by delay.

Paracentesis is practised by introducing a trocar cannula in the median line midway between the umbilicus and the symphysis pubis. It is best done with the patient sitting in a chair if possible. A binder is passed around the abdomen, the ends of which are held by an attendant. As the fluid flows out, the ends of the binder are drawn in snugly so as to make firm and even pressure over the abdomen and prevent a sudden engorgement of blood in the abdominal veins. At the termination of the operation the cannula is withdrawn, the wound closed with cotton and collodion, and the binder firmly secured. If the abdominal walls are very thick it is best to make a small incision with a scalpel, which is afterward firmly closed with a suture, and the dressing applied. It is well to use a local anæsthetic, an ethyl chloride spray or preferably novocaine. Before the abdomen is tapped the bladder should be emptied. The site of the proposed puncture should be percussed and found to be dull. The usual antiseptic precautions must be observed. Prolonged or permanent drainage is not advisable.

Attempts at the reduction of the abdominal fluid are very generally practised through the agency of diuretics and purgatives. It sometimes appears as if they were in a measure successful, especially after pressure has been removed from the renal vein by tapping. This relieves the venous engorgement and allows the absorption of the remaining fluid. On the whole, medical measures to reduce the abdominal fluid are disappointing.

In cardiac cases the diuretics commonly used are combinations of digitalis, squill, and mercury, caffeine citrate, and sodium theobromine salicylate. The latter may be used by itself or combined with digitalis.

In ascites due to other causes, the acetate, citrate, or tartrate of potash, or the spirits of juniper have been advised. Apocynum has also been advised but it is a gastro-intestinal irritant. The purgatives employed are calomel and jalap, and such salines as the tartrate of potash, the sulphate of magnesium or of sodium. Violent purgation by such drugs as elaterium and gamboge are too drastic, they being too much of a drain upon the strength of the patient.

In the ascites following cirrhosis of the liver attempts have been made to establish collateral venous circulation between the general and portal systems by artificial peritoneal adhesions. The method was devised by Talma. In selected cases, those who are in fair general condition, the operation is worthy of a trial, as a small percentage of good results have followed. The mortality following it, however, is high, a point that must be carefully considered.

Hæmoperitoneum.—This condition is usually due to ruptured viscus or blood-vessel, though at times a malignant growth may be the cause. The treatment in any case is surgical.

ii. Acute General Peritonitis.

The cause of acute general peritonitis is usually infection by some bacteria, and the introduction of such bacteria into the peritoneal cavity is most often due to the rupture of an abscess of an abdominal viscus into the peritoneal cavity.

Treatment.—The treatment of peritonitis is both medical and surgical. Given the diagnosis of acute diffusing peritonitis, the first question to be decided is when to operate. Where the case is that of a ruptured appendix, and seen within the first thirty-six to forty-eight hours immediate operation is indicated. Only in the late cases—those first seen after the third day—is it advisable to wait for localization to take place. Many surgeons do not use the Ochsner method at all, feeling that operative drainage of the exudate is the safer and more advisable procedure, in spite of the danger of spreading infection. Results on the whole show that the more successful cases are those that have the advantage of early operation.

The peritonitis following intestinal obstruction, gastric, duodenal, gall-bladder, intestinal and colonic perforation demands immediate operation, as soon as the condition is recognized.

The guiding surgical principles should be to operate early, preferably under local anæsthesia, removing the focus or stopping the source of infection; to disturb the parts as little as possible in order that the infection is prevented from spreading; and to establish adequate drainage. The viscera must not be brought out of the abdominal cavity as the mortality following this practice is as great as the disease itself. No attempt should be made to irrigate or dry sponge the cavity.

The after care of patients who have been operated upon for a general peritonitis is important. To facilitate drainage, and to drain the exudate into the pelvis where absorption is less, the patient is put into the Fowler position. This is a semi-recumbent posture the body being raised 35 to 40 degrees on the axis of the pelvis. Special bedsteads are now obtainable, which can be so adjusted that the patient is comfortable. As a rule the position is a grateful one as it makes respiration easier. Proctoclysis in the form of the Murphy drip should be started. If this gives distress or is difficult to retain, hypodermoclysis should be resorted to.

If distention occurs reliance should be placed on enemata or colonic irrigations. The latter are best as they create less intestinal peristalsis if care is taken to let a small amount of water run in slowly and then flow out again, and not to over-distend the bowel. Puititrin, an ampoule, given every half hour for two or three doses, the last dose being followed with the colonic irrigation, often gives very satisfactory results. No cathartic should be given until ample time has been given for local adhesions to form, which would be after the third day. No food or liquids should be given by mouth for at least forty-eight hours, and then, if vomiting has stopped, small feedings of broth may be allowed. Lavage of the stomach offers the

best means of controlling vomiting. Morphine may be administered for pain and restlessness.

MEDICAL MEASURES.—Peritonitis is dangerous in proportion to the amount of absorption that occurs, and it is not the inflammation of the peritoneum that is fatal. Medical measures are naturally but palliative. In diffused and in most cases of localized peritonitis, surgical intervention is necessary both for the removal of the focus and to prevent reinfection.

The first consideration is to put the part at rest, and it is found that nature does much of this by inhibiting peristalsis. Rest facilitates adhesions and the walling-off of an infected area, and peristaltic activity tends to spread the infection where it would otherwise remain localized. It is for this reason that the use of purgatives is so dangerous.

Anything given by mouth will increase peristalsis, therefore it is essential to withhold both food and water. The organism can well enough do without food for days, but water is necessary on several counts. It washes out the toxins, helps combat the collapse, fills the blood-vessels and gives the heart something to contract against; and by filling the vascular system with water, the absorption of toxins from the peritoneal cavity is to some extent inhibited.

Water should be administered per rectum as normal salt solution, a sodium bicarbonate solution, or a five per cent glucose solution. The latter has the advantage of preventing the development of acid intoxication, but it also at times will prove irritating and causes an increase of abdominal discomfort and tympanites. This may be obviated in part by cleansing the bowel with a small enema or irrigation. Mead's dextri-maltose is said to be less irritating and is sometimes better borne than glucose.

In some patients the Murphy drip causes discomfort, regardless of the solution used. In such cases the slow injection into the rectum of fluid in quantities varying from 300 to 450 cc. (10 to 15 ounces) will be found to be more satisfactory. At times proctoclysis in any form causes so much distress that it must be discontinued, and the water must then be introduced either intravenously or by hypodermoclysis.

Morphine helps to further inhibit intestinal peristalsis and keeps the pain under control. It also lessens shock by preventing painful impressions from reaching the central nervous system. The objection to morphine has been that it increases intestinal paresis and produces more distress, but it must be remembered that intestinal paresis is the desideratum of the treatment as it is one of the main factors in preventing the spread of the infection. Small doses apparently do increase the discomfort, but when given more freely this is obviated. Crile gives morphine sufficient to lower the respirations to twelve or fourteen per minute. While many hesitate to push the drug to such an extent, nevertheless its use in sufficient amounts to keep the patient comfortable and free from pain is definitely indicated. In spite of the paralyzing effects of morphine patients can expel flatus freely. Morphine should be used with caution until the diagnosis is made, as otherwise it may obscure both physical signs and symptoms.

Vomiting and retching are best treated by stomach lavage. Usually by withholding all mouth feedings this symptom soon subsides.

The question of cathartics is always a difficult one. It is highly desirable to move the bowels and rid the system from the absorption of toxins, yet increased peristalsis favors a spread of the infection. Enemata, no matter how small or carefully given, excite peristalsis. The best method of clearing the bowels would seem to be colonic irrigations. By this means small quantities of a solution of bicarbonate, 30 grams (1 ounce), to the liter (quart) of warm water, can be introduced without pain or discomfort, and allowed to flow out again, relieving the colon of much fecal material. The procedure can be repeated two or three times in the twenty-four hours.

The ice-cap or cold compresses applied to the abdomen are of questionable value. Whether cold has any power to control an extending infection seems highly problematical. The discomfort of the weight on the abdomen would appear to outweigh its advantages, and would besides, in a measure, mask signs and symptoms from the local anæsthesia produced.

Collapse calls for stimulation, such as strychnine and caffeine and the application of heat to the body surface.

iii. Acute Circumscribed Peritonitis.

It matters little whether the inflammation or abscess follows an acute appendicitis, an oöphoritis, or is due to infection beneath the diaphragm; laparotomy must be done and the abscess cavity drained.

iv. Chronic Peritonitis.

The treatment is very unsatisfactory. Surgical interference is almost impossible because of the extent of the adhesions, and even if it is practicable to free them, they quickly reform and are usually more extensive than before the operation. Great care must be taken that the action of the bowels is free.

v. Tuberculous Peritonitis.

Treatment.—At the start it is well to bear in mind that at least fifty per cent. of cases are cured by medical measures. Such measures are those that are applied to tuberculosis in general—fresh air, sunlight and rest with a full nutritious diet.

Benefit has been derived from the use of *tuberculin* and it may be tried in selected cases. The Röntgen rays have been tried, and it would appear that some cases have been favorably influenced by their use. The disappearance of the effusion may be hastened by cathartics and diuretics. My personal experience, however, would lead me to believe that the latter have but little influence and are often exhausting to the patient.

It is not always easy to decide when surgical intervention is indicated or just what should be done. In general, laparotomy is indicated in tubercular serous effusions that do not yield to medical measures.

In acute miliary cases with involvement of other organs nothing can be expected from surgery. Where the peritoneal involvement follows a quiescent focus, elsewhere in the body, the opening of the abdomen, allowing the exudate to escape and exposing the peritoneum to the air, often leads to a cure. There is no advantage from washing the abdomen.

Further surgical indications are where there is reason to suspect a tubercular process in fallopian tubes, appendix, or the presence of a localized suppurative process. The primary focus must be removed if possible in addition to simply opening the abdomen. Conditions producing complete or partial intestinal obstruction demand surgery. The ulcerative types are not suitable for operative intervention and this should not be resorted to except to relieve definite conditions.

The dry adhesive type offers the worst prognosis and nothing is to be gained by surgery. It is in this type that fæcal fistula so often occurs showing little tendency to recover. Intestinal obstruction from bands is common.

Where the tubercular process is localized it demands more energetic treatment. Here the focus must be sought out and if possible removed. Such foci may be found in the appendix, cæcum, ascending colon, ileum, and in women, the fallopian tubes. By removing the source, good results are often obtained.

Just how opening the abdomen, allowing the exudate to escape and exposing the peritoneum to the air, brings about an improvement it is hard to say. From animal experimentation, it might appear that the hyperæmia resulting from a change in intra-abdominal pressure and exposure to air, is stimulating to the natural defence mechanism, by bringing a fresh supply of blood and lymphocytes to the part.

Operative treatment is proportionately more successful in the less acute cases and is contraindicated in the more acute ones with fever.

Adhesions should not be disturbed. Where large collections of localized fluid exist, they should be emptied and the abdomen closed without drains. Nitrous oxide anæsthesia is preferable to prevent lighting up or aggravating pulmonary lesions.

Tuberculous peritonitis calls for close coöperation on the part of both the physician and surgeon.

vi. New Growths in the Peritoneum.

Surgery offers the only hope of any relief in these conditions. Benign tumors that cause symptoms can usually be easily removed and the results of the operation are satisfactory. Malignant growths have usually progressed to such an extent by the time operation is considered that any hope of relief is gone.

vii. Retroperitoneal Sarcoma.

The onset of this affection is insidious and any hope of relief by surgery is out of the question.

XII.

THE TREATMENT OF DISEASES OF THE
RESPIRATORY SYSTEM.

I. DISEASES OF THE NOSE.

J. R. DAVIES, JR.

i. Acute Rhinitis: Coryza.

Preventive Treatment.—The wearing of proper clothing in the varied seasons is important; the selection rests with the individual rather than upon any definite set rule. The underclothing should be of such texture that it does not hold moisture, thus preventing the chilling that occurs when the more closely woven garment is employed.

Plenty of fresh air in the sleeping apartment is essential. Outdoor exercise is salutary. Those subject to "colds in the head" should, when overheated, avoid sudden chilling.

The diet should be regulated and the habit of daily evacuation of the bowels acquired. The morning shower bath or cold water sponge will increase the vascular tone which in many sufferers is subnormal.

Autogenous vaccines made from the secretions of the nose and pharynx, or the stock cultures prepared in the commercial biological laboratories have proven extremely valuable as a preventive measure of colds to some clinicians, while another equally honest division of physicians have used them without appreciable results.

To check a cold in the head a thorough purgation with blue mass or calomel followed some six to eight hours later by citrate of magnesia or some other saline is supported by clinical results. This should be followed by Dover's powder, 0.3 to 0.6 gram (5 to 10 grains), a hot mustard foot bath, and a hot lemonade or whiskey punch. The patient should be put to bed and care exercised to prevent chilling during the sweat that follows. Hexamethylenamine in 0.3 gram (5 grains) doses is useful at the outset as are salol and acetylsalicylic acid in the same doses in rheumatic subjects. A combination of salol and strychnine taken once in three hours is useful. Atropine or belladonna in small doses will dry up the secretion but it is not infrequently overworked.

Locally applied on cotton, a weak solution of cocaine and antipyrin, each two and one-half per cent., will shrink the turbinates. The nostrils are then cleansed with a mild alkaline solution, such as *liquor antisepticus alkalinus* and twenty per cent. argyrol painted upon the inflamed membrane. Epinephrin is not advisable, since the secondary congestion is often worse than the primary condition. A spray of camphor and menthol, each one-half per cent. in liquid petrolatum, may be used by the patient and will be found helpful. Plain white vaseline, conveniently marketed in small tubes, is very soothing and beneficial when squeezed into the nose.

ii. Chronic Hypertrophic Rhinitis.

The prophylactic treatment applied in acute rhinitis holds in this condition. Locally a cleansing alkaline solution such as Dobell's, or *liquor antisepticus alkalinus* should be used twice a day followed by liquid petrolatum, camphor and menthol spray.

The nose should be cleansed with a mild spray, after first cocainizing with two and one-half per cent. solution, followed by an application of a solution of iodine and potassium iodide, five per cent. of each, in glycerine. If there is much redundancy of the mucous membrane of the turbinates, lineal cauterization with chromic acid is advisable. An applicator is heated, dipped in chromic acid crystals, and then heated until a bead forms and the area cauterized. Possibly three or four such applications will be necessary to contract the tissue. Caution must be exercised in the use of chromic acid so as not to cauterize more tissue than need be.

The electric cautery applied at very red heat may be used in place of chromic acid.

In many cases it will be necessary to remove a portion of the turbinate. This can be done by several methods. Probably the cold wire snare is as good as any. If there is much bleeding the nose should be packed with gauze.

A deviation of the septum, if present, should be corrected before the turbinate is removed. Care should be exercised not to remove too much tissue as, in the subsequent cicatrization, the tissues will be so contracted that the turbinates will have almost disappeared.

iii. Atrophic Rhinitis.

The treatment is tedious and requires patience and perseverance. The first, and probably the most essential part of the treatment, is cleanliness. The patient should be instructed to use a cleansing solution, such as Dobell's or *liquor antisepticus alkalinus*, in the nose night and morning. By this means the crust formations are softened and the patient can more readily remove them. An ointment such as yellow oxide of mercury or an oil spray of camphor, menthol and liquid petrolatum is useful in the nose after cleansing. It is stimulating to the mucous membrane and at the same time tends to soften the crusts and facilitate their removal. If there is a great amount of odor, a weak solution of potassium permanganate can be used as a cleansing agent.

The nose should be treated locally several times a week by cleansing and removing all the crusts. This can be done by a watery spray and an applicator wound with cotton. After the nose has been thoroughly cleansed an application of a solution of iodine and potassium iodide, five per cent. of each, in glycerine should be made. Ichthyol, while rather unpleasant, is valuable in some cases. The treatment must be persisted in over a period of several months if any definite results are desired.

If there is an anatomical deformity of the nose, such as a deflected septum or a nasal spur, it should be corrected.

A Wassermann test may throw some light upon the condition.

Another form of treatment that has been suggested in atrophic rhinitis is the injection of paraffin beneath the mucous membrane. The membrane is stimulated by the irritation of the paraffin acting as a foreign body.

Another method is to pack the nose with dry gauze and allow it to remain for twenty-four hours. This is then removed and, after cleansing, the nostrils are repacked. By the irritating action of the dry gauze the mucous membrane is stimulated.

iv. Suppurative (Purulent) Rhinitis.

Diseased tonsils and adenoids, if present, should be removed. If there is an infection of the accessory sinuses it should be treated, and the nose and throat put in the best anatomic condition possible.

The local measures used in the nose consist of a thorough cleansing with a mild alkaline spray, and the instillation, by means of a blunt eye-dropper, of a ten to fifteen per cent. argyrol solution. This may be followed with a mild oil spray.

General hygiene, proper food, plenty of fresh air, exercise, and suitable ventilation of the room at night, are essential. The cold sponge bath in the morning is helpful to tone up the general circulation. Some tonic such as the syrup of iodide of iron, given over quite a period of time, is most beneficial.

v. Vasomotor Rhinitis (Hay Fever—Rose Cold).

The treatment of vasomotor rhinitis is most unsatisfactory although, in a certain proportion of cases, the use of pollen extracts and autogenous vaccines gives a fair degree of success.

Pathological lesions in the nose, such as polypi, deviation of the septum, degeneration or hypertrophy of the turbinates should be treated or corrected surgically. If possible, it is best to do any required surgery in the intervals rather than during the period of attack. If there is an underlying constitutional disease, attention must be directed to it.

To cleanse the nose the patient should be given some alkaline spray such as *liquor antisepticus alkalinus*, diluted with equal parts of tepid water, followed by a bland oil spray. White vaseline is often useful for the patient when traveling, as dust and dirt irritate the mucous membranes. This can be obtained in convenient tubes and thus squeezed into the nose. Menthol and camphor very frequently irritate the mucous membrane and should be used in mild doses in an oil spray.

In the physician's office cocaine will probably give more relief than anything else. A small pledget of cotton saturated with a weak solution of cocaine and antipyrin, each two and one-half per cent., placed in the nostrils will give immediate relief. Cocaine should never be given to the patient as the habit is easily formed. Argyrol in a twenty per cent. solution may be used in the nose followed by a bland oil spray.

Doses of bicarbonate of soda, 0.6 gram (10 grains), three times a day sometimes afford relief when there is hyperacidity.

The pollen extracts undoubtedly offer the most satisfactory form of treatment, but here too the results at times are most disappointing.

An attempt should be made to determine the causal factor. The most convenient method is the injection into the skin of a small amount of one of the suspected substances. If positive a large wheal will appear within a few moments. Sometimes it may be necessary to go through the entire list of pollens, grasses, dust, feathers, and horse dandruff before the offending one is discovered. The technic is described in the section on asthma, page 382.

Having determined the causative factor, the vaccine is given hypodermically. It is well to start its administration so that it will be finished two weeks before the time the attack arrives. This, of course, is not always feasible and the treatment must be given during the attack. This is usually not so successful. An autogenous vaccine made from the nasal discharge is often a valuable adjunct when administered subsequent to the hay fever vaccine.

It is advisable, when the measures enumerated above fail, to suggest a seasonable change of residence. Sufferers should go away before the date of troublesome hay fever, and remain until the time limit of attack has fully expired. A sea voyage is often most beneficial. A few localities may be here recorded as favorable to these subjects: Rangeley Lakes, Maine, The Green Mountains, The Adirondacks, Thousand Islands, Pocono Mountains, Northern Michigan, Western Nebraska, Albuquerque, N. M., and Santa Cruz and Santa Barbara, Cal.

vi. Nasal Polypi.

Treatment.—The removal is a surgical measure, accomplished by a snare. Medical treatment is useless. The mucous membrane around as well as the base of the polyp should be cocainized. A four per cent. solution will, if allowed to remain ten minutes, give complete anæsthetization. The snare is slipped over the polyp, slowly tightened, and slight traction exerted when performing the operation. Very often a piece of necrotic bone will come away with the polyp. Examine with a probe for dead bone and if found, remove it. Ordinarily there is not much bleeding; if there should be, it is readily controlled by packing with gauze. This should be removed the next day and the nose cleansed. The packing does not usually need replacement. Frequently the operation can be completed at once, but it is preferable to do a part of the work at one time. Examine the patient in eight or ten months for recurrence; if present, remove the growths.

vii. Epistaxis.

Treatment.—As in hemorrhage elsewhere, the patient must be kept quiet. Cold should be applied to the nose, either as an ice-bag or by means of cold compresses. He should refrain from blowing the nose. A pledget of cotton saturated with epinephrin will often control the bleeding. If these simple measures fail the nose must be packed with gauze. This is done with a pair of nasal forceps. The gauze may be soaked in epinephrin or lubricated

with vaseline. If vaseline is used, it facilitates the removal of the gauze with little disturbance of the formed clot. The packing should be carried far into the nasal cavity and packed tightly against the bleeding point. When the bleeding is posterior it may be necessary to insert a postnasal pack. This can be best done by passing a small rubber catheter through the nostril until it appears in the throat, grasping it with a curved hæmostat, pulling it out of the mouth, tying a piece of heavy catgut or silk in the eye, and attaching to it a piece of gauze about the size of a walnut. Gently pull the catheter into the postnasal space, while guiding the packing past the uvula with the finger. Allow a piece of the silk to extend from the packing in the mouth and tie the end to the one extending from the nose. This will aid in its removal. The anterior nares requires the packing first described.

Hemorrhage from the nose or epistaxis is a symptom and not a disease; therefore, after controlling it, the causative factors must be determined and treated or the condition will recur. A few of these may be recorded, such as anæmia, hæmophilia, typhoid fever, cardiac disease and respiratory afflictions.

Locally nasal polypi, small ulcers of the septum, deflections and spurs of the septum must be corrected. Very frequently the bleeding is from a small vessel on the septum, just within the nostril. The best method to prevent hemorrhage recurring from this point is to cauterize the vessel either with the electric cautery or chromic acid. If there is a small ulceration kept irritated by picking, yellow oxide of mercury ointment in official strength, applied at night, will often prevent the formation of crusts.

viii. Deflections and Deviations of the Septum.

Treatment.—These conditions are usually surgical; therefore, the reader is referred to a text-book on nasal surgery. If surgery is not applicable, some mild alkaline wash followed by a camphor and menthol spray will afford partial temporary relief.

When the obstruction does not continuously interfere with nasal breathing, and is more physiological than anatomical, it is well to carefully examine the tonsils. Frequently they are cryptic and the pockets filled with cheesy deposits. If these crypts are kept clean, the improvement will not infrequently be marked. Sometimes an underlying constitutional condition will predispose to a vasomotor rhinitis and this, added to a slight deflection, will give the discomforts of complete obstruction. In minor deviated septum, with the attendant vasomotor symptoms, the examination for other causes of the symptoms will amply repay the physician.

ix. Perforation of the Nasal Septum.

Treatment.—In the early stages, the use of a cleansing wash such as *liquor antisepticus alkalinus*, and yellow oxide of mercury ointment, is serviceable. Silver nitrate in ten per cent. strength painted on the margins of the ulcer will sometimes stimulate healing.

If syphilitic, general antiluetic medication must be instituted.

Perforations in the majority of those afflicted cause little inconvenience; crusts may form, but these can be controlled by washes and bland ointments. If these measures are inadequate, a plastic operation for closure of the nasal perforation may be advisable.

x. Abscess of the Septum.

This condition, while not common, is occasionally encountered. In many instances it is syphilitic and requires active specific treatment to prevent the extensive necrosis and the subsequent disfigurement. The Wassermann test should be made, since the destruction of the septum in lues is very rapid. If it is the result of an infection, ice in the form of compresses will greatly relieve the swelling and pain. As soon as pus has formed an incision should be made to permit drainage.

xi. Lupus of the Nose.

The general rules of hygiene and diet for tuberculosis must be observed. Locally the x-ray affords the most satisfactory means of treatment.

xii. Syphilis of the Nose.

The treatment must be constitutional—arsenic, mercury and iodides when given energetically may be considered specific.

Locally the nose should be kept clean with a watery spray. Mucous patches should be touched with a twenty per cent. solution of silver nitrate. If crusts form, white vaseline and yellow oxide of mercury ointment will assist in their removal.

xiii. Malignant Growths of the Nose.

Both sarcoma and carcinoma occur. They frequently involve the nose by extension from the accessory sinuses. The treatment depends largely upon the type and the situation of growth. When feasible, the surgical removal and the postoperative use of radium or the Röntgen ray offer the best hope for a cure. Surgical interference is often impossible and the unsatisfactory symptomatic treatment must be applied.

xiv. Inflammation of the Accessory Sinuses.

Medical treatment will in many instances give the desired results, and it should be given a thorough trial before any radical surgical procedure is considered. The successful treatment requires good drainage from the nasal cavities. An acute cold in the head is responsible for many of the sinus infections. The general measures outlined in the treatment of head colds should be used. A saline purgative, a hot bath, Dover's powder, followed by one of the salicylates, should be used at the onset.

Locally, the mucous membrane of the nose should be contracted with a solution of cocaine and antipyrin, each two and one-half per cent. The

nasal cavity should be cleansed with a warm alkaline spray, and coated with a twenty per cent. solution of argyrol in equal parts of glycerine and water. A useful spray is camphor and menthol in liquid petrolatum. Epinephrin may be used in a 1-5000 solution. An ice-bag placed over the maxillary or frontal sinus will lessen the congestion and thus relieve pain.

If these simple measures do not give relief, surgical treatment may be necessary. Whenever possible, conservative intranasal operations should be tried before the more radical. Many of the chronic cases are benefited by the use of autogenous vaccines.

II. DISEASES OF THE LARYNX.

J. R. DAVIES, JR.

i. Acute Laryngitis.

Treatment.—Absolute rest of the voice is probably the most important item. If conversation is necessary, it should be carried on in a whisper; the telephone should be avoided, and smoking prohibited.

Inhalations of compound tincture of benzoin, 30 cc. in 500 cc. (1 ounce in a pint) of boiling water, to which a few drops of camphor have been added, is a very satisfactory measure. When used, however, the patient should be cautioned not to expose himself to cold air or draughts.

If there is much pain in the larynx an ice-bag applied to the throat often affords relief both from the pain and the irritating, rasping cough.

Locally, the nose and throat should be cleansed with some mild alkaline spray and a solution of argyrol painted on the nasopharynx. Argyrol painted on the larynx or dropped upon it from a small laryngeal syringe will be found beneficial.

For the irritating cough, codeine or heroin in small doses is indispensable. The usual accompanying nasopharyngitis also requires treatment. A cathartic, followed by salol, 0.3 gram (5 grains), every three hours, should be given. Plain white vaseline should be put into the nose. Chewing and swallowing vaseline will help to allay the "raspy" feeling in the throat. Lozenges of camphor and menthol will also bestow relief. A tonic such as nux vomica or its alkaloid, strychnine, may be needed in the latter stages.

ii. Chronic Laryngitis.

The examination of the nose and throat must be thorough. Nasal polypi, deviation of the septum and nasal spurs, if present, should be remedied. If the tonsils are diseased, treat or remove them if necessary. Disease of the accessory sinuses should be corrected. When practical, rest of the voice and a change of climate is to be desired; but as this condition occurs most frequently in clergymen, public speakers and singers, it is not always possible. When the condition arises from the improper use of the voice, the patient should be put in the hands of a competent teacher and taught the proper method of speaking and singing.

Locally, the larynx can be treated with a twenty per cent. argyrol solution, or ten per cent. silver nitrate solution. Inhalations of compound tincture of benzoin in proper watery dilution will often allay the irritation. If there is an associated irritating cough, small doses of codeine or heroin will be of assistance. Strychnine sulphate is often a valuable stimulant to the vocal chords as well as a general tonic. If there is much pain orthoform lozenges or iodoform powder, insufflated into the larynx, will often abate it.

iii. Tuberculosis of the Larynx.

While this may occur primarily in the larynx, it is practically always secondary to a pulmonary lesion. The same general treatment must be carried out in laryngeal tuberculosis whether a pulmonary lesion is demonstrable or not. Absolute rest of the voice is essential. The patient should be given a pad and pencil for communication. Unfortunately, this is not always possible. However, the patient should be impressed with the importance of it. The food should be free from condiments, soft so as to be easily swallowed, and finally, nourishing.

The local treatment depends upon the stage of the disease. In the early period, without ulceration, applications of twenty per cent. argyrol to the nasopharynx and larynx will often relieve the congestion. If there is a persistent irritating cough that interferes with the patient's sleep, codeine and heroin are of value. Inhalations of compound tincture of benzoin in boiling water afford relief from both pain and cough. Creosote, oil of eucalyptus, camphor, or menthol may be added.

Should pain interfere with deglutition, the larynx can be sprayed before eating with five per cent. cocaine solution. Orthoform lozenges will often yield relief, and have none of the objections to cocaine. Iodoform insufflated on the larynx also exercises mild anæsthetic power.

Where ulceration has taken place, the electric cautery will delimit it, and stimulate healing. Strong silver nitrate may be used in its place. Chromic acid should not be used if it is possible to apply the electric cautery.

Frequently intratracheal medication will allay the severe trachitis that is so often associated with this malady. A mild solution of camphor and menthol, in liquid petrolatum, is very useful. The larynx is first cocainized and from a laryngeal syringe about five drops of the solution is dropped into the larynx and trachea. The internal administration of such drugs as creosote, the calcium salts, certain iodine compounds, iron and cod liver oil, are of use when they do not interfere with digestion. Undoubtedly rest of the voice and the proper feeding and hygiene of pulmonary tuberculosis are most essential.

iv. Syphilis of the Larynx.

Primary syphilis of the larynx is never seen. It occurs as the secondary or tertiary lesions. Congenital syphilis of the larynx is extremely rare. The treatment of this condition is essentially that of syphilis generally, and should be begun as early as possible.

Locally, if ulceration is present, applications of silver nitrate in twenty per cent. solution should be made several times a week. Rest of the voice should be insisted upon, and the use of alcohol and tobacco prohibited. If there is pain upon swallowing, orthoform lozenges or powdered iodoform insufflated on the larynx will relieve it.

The local treatment of the larynx is secondary to the general antiphilitic treatment.

v. Œdema of the Larynx.

The treatment of œdema of the larynx must be instituted as soon as the diagnosis is made.

An active saline purgative should be given, as by this means some of the œdema may be reduced. Locally, silver nitrate solution painted on the larynx is extremely useful. A solution of epinephrin (1-3000) painted on the larynx is often helpful, but as in other localities, in the nose and throat it may be followed by a secondary relaxation. Adrenalin Inhalant sprayed or inhaled into the larynx can be used instead of applying the solution locally. An ice-bag applied over the larynx will often lessen the congestion. If œdema is extensive and dyspnœa marked, the tissue should be scarified. The larynx is anæsthetized with a ten per cent. solution of cocaine and the tissue is punctured in several places with a sharp knife. Inhalations of compound tincture of benzoin in boiling water will often lessen the dyspnœa. Should the condition become serious and the dyspnœa marked, either intubation or tracheotomy must be performed. If there is doubt as to which procedure is indicated, select tracheotomy.

A search must be made to discover the cause of the œdema and if found to be cardiac or renal in origin, treatment of the underlying disease is of prime importance.

vi. Benign Tumors of the Larynx.

(a) **Singer's Node.**—These usually occur in school teachers, clergymen, singers and public speakers. They are usually small, circumscribed thickenings on the edges of the vocal chords. They frequently result from using the voice too soon after an acute laryngitis. This fact should be borne in mind by public speakers and singers.

The treatment consists of rest of the voice for a long period of time. When possible, it is preferable before surgical interference. Locally, applications of silver nitrate may be helpful. The growth usually requires surgical interference, made possible by use of the direct laryngoscope.

(b) **Papilloma, Fibroma, and Cystoma.**—Papilloma is by far the most frequent. There is practically no treatment other than surgical removal. This is best done by direct laryngoscopy either with local or general anæsthesia, depending upon the patient. In the writer's opinion, the use of the electric cautery is inferior to the surgical removal. Chromic acid and caustics are to be condemned.

vii. Malignant Growths of the Larynx.

Both carcinoma and sarcoma of the larynx occur; carcinoma is by far the more frequent.

When the patient is fortunate enough to have it diagnosed early, the removal of the larynx and affected glands should be immediately performed by the external route. To try to remove the growth by the intralaryngeal method is useless and should not be attempted. After the surgical removal, radium and the x-ray should be administered by an experienced person. Where operative interference is futile, the patient should be made as comfortable as possible. The throat should be cleansed with alkaline solutions and soothing oil sprays used. Orthoform lozenges and iodoform powder, on account of their anæsthetic properties, should be used. Morphine to relieve pain should be used as frequently and in as large a dose as is necessary.

If dyspnoea is marked, a tracheotomy may be performed. Radium and the x-ray are useful in inoperable cases to relieve pain and prolong life.

In sarcoma Coley's fluid should be tried, particularly in those cases which are inoperable. The restriction of tobacco and alcohol in inoperable cases depends entirely upon the individual, and if they give comfort should not be denied.

III. DISEASES OF THE EAR.

J. R. DAVIES, JR.

i. Diseases of the External Ear.

Perichondritis of the Auricle.—This condition, while occurring idiosyncratically, is most often the result of an eczema or furunculosis or an infection following an injury. Sometimes it is syphilitic in origin.

The canal of the ear should be examined, and if a furuncle is found it should be opened, the canal cleansed with hydrogen peroxide, and yellow oxide of mercury ointment, or preferably ichthyol ointment used in the canal to increase drainage.

The auricle may be covered with gauze saturated with lead water and laudanum or ichthyol ointment. An ice-bag placed over the ichthyol dressing is valuable in the early stages. As soon as there are definite signs of pus formation, the auricle must be incised. This should be done under general anæsthesia. It is of the utmost importance to do this before destruction of the cartilage has taken place. This accident will result in marked deformity of the ear.

Should the case be syphilitic in origin, general antisymphilitic treatment is required.

Hæmatoma of the Auricle.—This condition occurs almost always as the result of trauma, and is most frequently seen in boxers and football players. It has been supposed to occur spontaneously in the insane, but this too is probably traumatic.

The preferable method of treating this condition is to incise the auricle under anaesthesia, evacuate the clotted blood, and pack the wound with gauze saturated with sterile vaseline.

When the hæmatoma is small or when operation is impossible, the auricle should be covered with gauze saturated with lead water and laudanum. Ichthyol ointment, ten to twenty per cent., with an ice-bag placed upon the dressing, is effectual.

Frost-Bite of the Auricle.—The object of the treatment is to reestablish the circulation. This can best be done by gentle rubbing of the ear with cold water or snow, and gradually, as the circulation returns, increasing the temperature of the water until the circulation is fully established. Should suppuration and necrosis occur, surgical measures are required.

For the skin irritation that so frequently follows frost-bite, some bland ointment such as zinc oxide ointment or yellow oxide of mercury ointment should be used. Later a dusting powder of zinc oxide and boric acid can be applied.

An ear that has once been frost-bitten is always more sensitive to cold and must be protected.

Eczema of the Auricle.—This condition is most frequently associated with a chronic purulent otitis media. The condition usually responds readily to treatment with yellow oxide of mercury ointment and the proper care of the discharging ear. The scalp should be examined as the condition is often associated with dandruff.

Tumors of the Auricle.—Fibromata are the most common and should be removed surgically. Carcinoma and sarcoma are uncommon in this location. The treatment is the same as that of malignancy found elsewhere. Cysts of the auricle require surgical removal.

ii. Foreign Bodies and Obstructions in the External Auditory Canal.

Foreign Bodies.—These may be divided into inanimate and animate.

The inanimate can be subdivided into those which swell when exposed to warmth and moisture, such as beans, rosebuds, etc., and those not influenced by heat or moisture, such as glass beads, pebbles, etc. The vast majority of inanimate foreign bodies which do not respond to temperature and moisture can be removed by a syringe. Those objects which swell may be reduced in size by dropping alcohol into the ear and then removing them by forceps or an ear hook.

Animate objects frequently fasten the small claws on their feet to the membrana tympani and the buzzing of their wings causes intense tinnitus. It is necessary to kill the insect before attempting its removal. Alcohol dropped into the canal will do this readily. The insect can be easily removed by a syringe.

Should the foreign body be so impacted that its removal through the external ear is impossible, an opening posterior to the ear, under general

anæsthesia, must be made. The canal wall is separated from its bony attachment, and the foreign body thus removed.

Impacted Wax or Cerumen.—This is the most frequent obstruction of the external auditory canal. It can usually be removed by syringing the ear with boric acid. This should be warm and the stream so directed that it strikes the plug of wax at its periphery instead of its center. When the stream is directed against the center, it forces the wax further in. When the wax is extremely hard, it may be necessary to soften the wax before removal by having the patient frequently drop warm glycerine or hydrogen peroxide into the ear, for a day or two. There is less likelihood of injury to the canal by this method than when instruments are used. Examine the ear at frequent intervals during the syringing. No unnecessary syringing should be done because vertigo frequently results from excessive washings. After removing the wax, dry the canal with cotton, and if there are signs of irritation, apply yellow oxide of mercury ointment. Have the patient retain cotton in the ear for 24 hours after removal of the wax to prevent dust irritation. These patients should be cautioned not to use soap when washing the ears since it predisposes to recurrence.

Furunculosis (Acute Circumscribed Inflammation of the External Auditory Canal).—If seen early, it may be possible to abort this condition by the application in the canal of ichthylol ointment, twenty or thirty per cent. and an ice-bag. Unfortunately, this is most frequently impossible and the condition goes on to pus formation. When pus has formed, the furuncle should be incised and its contents evacuated. A solution of equal parts of cocaine, phenol and menthol, if applied on a piece of cotton for ten minutes before the incision is made will greatly lessen the pain. The ear should be kept clean with a solution of boric acid until the furuncle has healed.

This condition is apt to recur by reinfection. Autogenous vaccines may be beneficial.

Many patients are in poor physical condition, hence tonics are indicated. If diabetic, constitutional and dietetic measures are in order.

Diffuse Inflammation of the External Auditory Canal.—This frequently results from attempts to scratch the ear with a toothpick, hairpin or some similar instrument. The treatment consists of applying yellow oxide of mercury ointment to the canal, and the use of heat or cold.

iii. Diseases of the Middle Ear.

Perforation (Traumatic).—In traumatic perforation of the ear-drum it is best to leave the ear absolutely alone. No attempt should be made to remove the clotted blood. Syringing the ear is absolutely contraindicated. Cotton placed in the ear is sufficient local treatment. If vertigo follows the injury, confine the patient to bed for a few days, and prescribe a very light diet. If there is pain, an ice-bag will often give relief. Unfortunately, suppuration occurs and when it does, should be treated as a suppurating ear from any other cause. Should the vertigo persist the patient must be kept in bed, an ice-bag applied to the ear, and nerve sedatives administered.

Myringitis.—Ice applied to the ear gives the best results. Many cases, however, seem to be benefited by heat. It should always be tried when cold fails. A warm solution of 5 per cent. cocaine in glycerine dropped into the ear usually relieves severe pain.

Acute Catarrhal Otitis Media.—As this condition most frequently either accompanies or follows a "cold in the head," its prophylactic treatment is the same as that for repeated colds. Deflections of the nasal septum should be corrected. Diseased tonsils should be removed, also adenoid growths or any obstruction interfering with the proper aeration of the Eustachian tubes. In individuals suffering from frequent head colds with no pathological condition of the nose or throat, the use of vaccines is indicated.

When acute catarrhal otitis media has developed, pain is the most urgent symptom. In most cases an ice-cap will afford relief, but frequently in children and elderly patients who suffer from neuralgia, heat is to be preferred. A warm solution of 5 per cent. cocaine, in glycerine, dropped into the ear, often gives comfort. Warm boric acid solution will also afford some relief.

The accompanying cold in the head should be treated. A saline purge, followed by 0.3 gram (5 grains) of salol, every four hours, is of the utmost benefit in the beginning. Locally, the inflamed and swollen mucous membrane of the nose should be contracted with a solution of cocaine hydrochloride and antipyrin, each two and one-half per cent. Washing the nose with sprays is absolutely contraindicated in acute inflammations of the upper air passages. Ten per cent. solution of silver nitrate painted at the orifice of the Eustachian tubes is beneficial. A gargle of hot normal salt solution often aids in opening the tubes, due mainly to the mechanical action of gargling. As to the advisability of inflating the Eustachian tubes, either with the catheter or the Politzer bag, there is a divergence of opinion. In the vast majority of cases it is better not to inflate.

The drum should be incised as soon as there is evidence of fluid formation. This is demonstrated by bulging of the membrana tympani. Indeed this point cannot be too strongly emphasized. It is better to err by opening the drum unnecessarily than to wait until it ruptures. For this purpose some anæsthetic is necessary. For young children a general anæsthetic is preferable. Ethyl chloride and chloroform are probably the most satisfactory. In adults, however, a local anæsthetic can be used and for this purpose nothing excels equal parts of cocaine hydrochloride, phenol and menthol. These crystals deliquesce, forming a thick colorless liquid. A small plug of cotton should be saturated with the solution and allowed to come into contact with the membrana tympani from ten to twenty minutes. In the vast majority of cases, the drum can be incised without pain. The incision is usually made at the point of greatest bulging which is, most often, the lower posterior quadrant of the membrana tympani.

After the drum is incised, the escaping serum can be removed with cotton. The ear should be left alone and under no circumstances should it

be syringed. As a rule the drum will heal in a few days. There is apt to be partial deafness persisting for several days or weeks after the acute condition has disappeared. Should this occur, gentle inflation of the Eustachian tube may be practised with the Politzer bag, and the membrana tympani gently massaged with the otoscope.

Acute Purulent Otitis Media.—The etiology of this condition is identical with acute catarrhal otitis media, and its prophylactic treatment the same. It is well to bear in mind its frequency in measles, scarlet fever and influenza; therefore, the ears should be especially watched for early signs of inflammation.

The treatment consists of prompt incision of the ear-drum with its drainage of the middle ear. The ear-drum should not be allowed to rupture spontaneously since it predisposes the patient to mastoiditis and intracranial complications. A plug of cotton should be put into the ear and the patient told to change it when it becomes saturated. If the pain persists an ice-bag will not infrequently give comfort. However, heat is sometimes preferred. If the drainage is profuse, the ear can be gently irrigated on the third day with a warm boric acid solution. Acute purulent otitis media terminates in from two to five weeks.

Anticipate mastoid complications. At the first sign of involvement, ice should be placed over the mastoid region; and if the symptoms persist operative interference is indicated.

Chronic Catarrhal Otitis Media.—A careful examination of the nose and throat is of vital importance, and abnormalities disclosed must be corrected.

Locally the nose should be cleansed with a mild antiseptic solution and the ears gently inflated with the Politzer bag. The membrana tympani should be gently massaged with a Sieglé otoscope or some modification of it.

When it is impossible to open the Eustachian tubes with the Politzer bag, the tube may be catheterized. In obstinate cases the vapor of chloroform blown through the catheter may open the occluded tube.

Many are benefited by regular night and morning gargling with normal salt solution.

Treatment should be directed to underlying constitutional diseases. Iron and arsenic are commonly indicated. If tinnitus is persistent, bromides are useful.

Chronic Purulent Otitis Media.—This is the continuation of acute purulent otitis media. It is often due to improper treatment or neglect of an earlier condition; or, on the other hand, the infection may be so virulent that necrosis of bone has taken place before it can be checked. Naturally the prevention consists in the early recognition of the acute form and its prompt and efficient treatment.

Pathological conditions in the nasopharynx such as diseased tonsils, nasal polypi, deviation of the septum, adenoids, etc., must be corrected before definite improvement can be expected.

The objects of treatment are:

- (a) The cessation of the discharge.
- (b) The prevention of intracranial complications.
- (c) The restoration of the hearing.

When the discharge is profuse a gentle syringing with warm boric acid solution twice daily will assist in keeping the ear clean. One of the safest ways of doing this is by means of a blunt, glass eyedropper. The boric acid is dropped into the ear. The suction of the dropper can be used to remove much of the tenacious discharge. The ear should be dried as thoroughly as possible and some antiseptic astringent solution dropped into the ear. One of the most useful is the following: Formalin 0.2 cc. (3 minims), boric acid 0.6 gram (10 grains), alcohol 15 cc. ($\frac{1}{2}$ ounce), water q.s. 30 cc. (1 ounce). This solution is dropped into the ear at bedtime after cleansing with boric acid solution. Catheterization of the Eustachian tube may force the accumulated purulent matter out of the middle ear.

The use of vaccines is indicated, but unfortunately, the results are oftentimes disappointing. However, they are worthy of trial and should be used in unresponsive conditions.

Removal of polypi or granulations will help the desirable drainage and can best be accomplished by the wire snare. The polypi are first anæsthetized by a cocaine, phenol and menthol solution. If the granulations are small, strong silver nitrate solution will aid in their removal. The electric cautery can be used but chromic acid is not advisable. The patient should be impressed with the seriousness of the condition and the possibility of intracranial complications. The ears should be examined at regular intervals.

Unfortunately, conservative treatment frequently fails and the only hope for cure lies in a radical mastoid operation.

Otosclerosis.—Local treatment, in the majority of individuals, is contraindicated. Harm is frequently done by constantly inflating an already dilated Eustachian tube.

The outlook is not hopeful. The patient's general health should be improved by hygienic, climatic, dietetic and medicinal measures. Such drugs as phosphorus, iron, the iodides and bromides are useful.

IV. DISEASES OF THE BRONCHI.

C. H. TURNER.

i. Bronchitis.

Prevention.—Acute and chronic bronchitis are so common that stress should be exerted to delimit the causal factors. From an etiological viewpoint it is of paramount importance to accustom the individual to sudden climatic variations. Infants, children and adults should live and sleep as much as possible in the open air. This hardening process must be a gradual one, especially in delicate subjects and in the aged. Those prone to nasopharyngeal infections must be guarded against strong winds, drafts and

dampness. Give careful attention to the ventilation of home and bedroom, school and shop. Overheating with a dry atmosphere is to be avoided since it renders the mucous membranes very susceptible to inflammation. The clothing should be suitable for the season—not too scant nor too heavy, but light and absorbent. The “ordinary chest protector” sold over the counter is to be condemned. Have damp or wet clothing changed to warm dry clothing, especially after fatigue. The temperature of the daily bath should be adjusted to the age and constitution of the individual. Recommend an occupational change to bronchitic sufferers when they are exposed to a dust-laden atmosphere, whether organic or inorganic, or jeopardized by irritating odors. The nasopharynx should always have careful consideration. Anatomical defects, nasal polyps, adenoids, diseased tonsils, inflammation of the mucous membrane of the upper respiratory tract, together with oral sepsis, should be treated by those especially trained for this work. The bronchitis of the acute infections, influenza, whooping cough, measles, etc., is a part of the symptom complex of these diseases, and therefore cannot be prevented, but careful management will do much toward lessening the severity and shortening the attack. A thorough investigation should be made to determine the causative agent of asthma and hay fever in order to desensitize the patient and thereby prevent the bronchitis which trails it. The prevention, alleviation or correction of bronchitis due to constitutional diseases—cardiac, renal, gastro-intestinal, etc.—demands treatment directed to these systems. Vaccine therapy for the prevention of acute bronchitis is a mooted question, but there is no doubt according to reports of some clinicians, that an autogenous vaccine oftentimes does much good in the chronic form of this disease.

(a) ACUTE BRONCHITIS.

Abortive Treatment.—Diaphoretic and diuretic measures are adopted more often than any other in the prevention of acute bronchitis. Bronchial congestion may be relieved by free perspiration. This is not infrequently produced by a hot mustard foot bath, followed by a tumbler of hot lemonade and rest in bed, well covered with blankets; or a Turkish, vapor or hot air bath may be substituted if due after-precautions are taken. A dose of Dover's powder, 0.5 gram (7 grains), with a hot drink is sometimes, in hearty adults, preferable to the above.

A free purge may be given, especially to robust subjects. The time-honored custom of giving calomel or blue mass before retiring, and a saline laxative the next morning, is well known by the laity to relieve symptoms of an oncoming “cold.”

Some physicians resort to the use of alkalies, *viz*: sodium bicarbonate, 0.5 to 1.0 gram (7 to 15 grains), hourly, or to the same dosage of ammonium or potassium citrate every three hours, even though free perspiration is not produced.

Attempts are sometimes made to delimit the coryza by direct local application to the mucous membrane of the upper air passages or by the way of the nerve or vascular systems. The agents used are in the form of powders, snuffs, vapors and the essential oils. A few of the commoner may be registered, *viz*: camphor, bismuth subnitrate, morphine, cocaine, silver salts, carbolic acid, iodine, menthol and eucalyptus. The internal remedies are either stimulating or sedative—quinine 0.6 gram (10 grains) upon retiring, or potassium bromide in free dosage. The use of the antipyretic coal-tar products—acetanilid and phenacetin, as well as the proprietary aspirin—should be condemned.

Hygienic and Dietetic Treatment.—When the abortive measures have failed to check the inflammatory process, the patient should be confined to bed until convalescence is well established. If this disease is to be considered an infection—and it is—partial isolation is in order and all nasal, oral and bronchial discharges must be destroyed. Sneezing, coughing and talking vitiate the air, the clothing, the bedding and the furniture with a fine spray of mucus impregnated with bacteria which may infect another person; therefore, the use of a face mask is logical for patient and attendant alike.

The room should have a temperature of 65° F. and the air be constantly or regularly changed, care being taken to avoid draughts. A liquid diet should be given at stated intervals—every three or four hours during the day—as long as a febrile temperature exists. Pure drinking waters or alkaline waters are important eliminants and should be freely given.

Symptomatic and Curative.—There is no specific for this disease; therefore the treatment is symptomatic, directed not alone to the pathological processes, but to the individual, giving due consideration to age, sex, habits, occupation and previous medical history. Many cases will recover, even though no medication is administered. The so-called fever mixtures, as citrate of potash, with or without sweet spirits of nitre, and the tincture of aconite every three hours may be employed with good results. Although antimony has fallen into disuse, the wine in 0.2 to 0.4 cc. (3 to 6 minims) doses every three hours is serviceable in very active inflammations. It relieves the chest tightness, the troublesome cough, and produces a moist skin. Sulphurated antimony, 0.01 gram ($\frac{1}{6}$ grain), combined with Dover's powder 0.06 gram (1 grain) may be given every two or three hours upon the back of the tongue, without water. Comforting relief is secured by applying to the chest a hot water bag, mustard plasters, spice plasters, hot oily preparations, heated flannels or stimulating liniments. Dry cups may be used, and in some suitable robust subjects venesection will relieve the dyspnoea of the early stage. Oxygen inhalations should be used if the dyspnoea is urgent. Inhalations of a steam-laden air, directly or in a bronchitis tent, will help to dispel the oppression if the mucous membranes are dry and swollen. The steam is obtained by boiling water in a croup kettle or in some "home-devised" apparatus. The usefulness of this method may be enhanced by the addition of compound tincture of benzoin,

two teaspoonsful to the pint. Carbolic acid, menthol, creosote or turpentine may be substituted. It is of the utmost importance to quiet the cough as much as possible, especially if it is dry, harassing, fatiguing or prevents sleep. Ipecac and squill are quite dependable. Sedatives are also to be given. Many are available, but opium or some derivative is best—*e.g.* codein, morphine, dionin, heroin or camphorated tincture of opium (paregoric), but belladonna, hyoscyamus, the bromide of ammonia, or chloral are not infrequently used. The secretion when well established must be removed. The ammonium salts are valuable mucus solvents, and at this period may be relied upon, *viz*: the chloride 0.3 to 0.6 gram (5 to 10 grains) and the carbonate in the same dose, the latter aiding if signs of cardiac failure appear. An excellent old-time prescription when secretion is present, difficulty of expulsion encountered, and cough troublesome, is ammonium chloride, ammonium bromide and ammonium carbonate, each 8.0 grams (2 drams), codeine sulphate, 0.25 gram (4 grains), fluid extract of liquorice, 60 cc. (2 ounces), distilled water, to make 180 cc. (6 ounces) in teaspoonful doses every three hours. If there are no signs of cardiac failure, the vehicle compound licorice mixture (brown mixture) may be used. It has an advantage in that it contains antimony. Potassium iodide is occasionally used in this period of the disease. When these drugs fail to aid in the expulsion of secretion, terpin hydrate in 0.6 gram (10 grains) capsules three or four times daily, or the elixir of terpin hydrate with heroin may be given with good results. If the secretion is excessive, which sometimes occurs in the aged and not infrequently in young children and in adults, the stimulating or relaxing expectorants are to be omitted. Atropin may be of service at this time.

Bronchitis in children is so frequently the forerunner of bronchopneumonia that it is important to carefully observe development. Cumston* counsels "rest in bed, poultices containing small amounts of mustard applied to chest for a few minutes several times a day, quinine in form of suppositories, and a sweetened infusion of linden flowers or calendula flowers." The latter, he says, "are quite extensively used by the French and Swiss, but are practically unknown to the American physician." He advises "baths of 97° to 99° F., every three hours, and cold packs to the thorax changed once in three hours for a temperature of 102.5° F. When respiration is difficult, a menthol ointment is applied to nares, and if mucus is causal, ipecac in the form of syrup is indicated."

(b) CHRONIC BRONCHITIS.

Climatic and Dietetic Treatment.—On account of the varied and multi-form causes of this condition the patient must be removed from influences which are injurious. Only in this way can an alleviation or a cure be obtained. A change of climate is desirable. To protect against sudden temperature changes during the cold winter months, a residence may be

* N.Y. Med. Jour.

established in the warm, moist, equable climate of Southern California, Florida, the West Indies, or upon the European or African coasts of the Mediterranean. Some individuals do much better in warm dry climates, as Arizona, Colorado, New Mexico and Mexico. The summer home, especially of dwellers in large cities, should be free from dust. A wooded district in America may be chosen; a good selection for summer out-door life can be made from the following: Muskoka Lakes, New England States, Pacific States, and Rocky Mountain foothills. Those who cannot avail themselves of these seasonable changes on account of finances or ill health must be kept indoors during violent cold season outbreaks, although at other times they may have free access to the open air. Old people who are bronchitic sufferers may with advantage be "completely housed" from early autumn until late spring. The diet should be suitable for the individual, bearing in mind that the patients are not infrequently harassed with a variety of gastrointestinal diseases. The chronicity of the disease and the necessity of maintaining the general nutrition must be constantly thought of when ordering preparations which disorder the digestion; hence opiates are to be given only when urgently required by excessive cough. There is usually a venous stasis of the digestive tract which calls for frequent saline laxatives.

Symptomatic Treatment.—Here, as in the acute form, the treatment is symptomatic. In the dry catarrhal forms, drugs used to promote secretion are similar to those employed in acute dry bronchitis. Steam-laden air medicated with camphor, menthol, turpentine, creosote or compound tincture of benzoin is not infrequently advantageous. Ammonium chloride and ammonium carbonate are useful. Iodine, especially potassium iodide, is most beneficial in the treatment of this disease when the secretion is scant and the expectoration difficult. If the secretion is plentiful or excessive, oil of turpentine 0.6 cc. (10 minims) in milk or in capsule every four hours, terpin hydrate 0.6 gram (10 grains), creosote 0.1 to 0.3 cc. (2 to 5 minims), or oil of sandalwood 0.1 to 0.3 cc. (2 to 5 minims) may give relief.

If dyspnoea is urgent and the discharge watery and profuse, belladonna, or its alkaloid atropin is indicated. Strychnine as a respiratory stimulant, and digitalis as a cardiac stimulant, are to be given when these systems demand support. Alcohol is of use in the aged and this is especially true if the patient has been accustomed to its use for a number of years. Arsenic and other hæmatinics are often indicated. If the Wassermann test is positive, and oftentimes when negative, antiluetic treatment may be given a trial if syphilis is clinically demonstrated.

Vaccine therapy may be employed if an autogenous vaccine can be made. This treatment has many advocates but is still unsupported by the majority of clinicians.

The physicians of Central Europe regard hydrotherapeutic measures superior to other plans of treatment. These medical men use sulphur baths not infrequently. This form of treatment must, however, be carried out in a well-equipped institution under the direction of trained attendants which makes it too expensive for the majority of bronchitic sufferers.

As a word of caution, let it be fully understood that in every instance the individual is to receive primary consideration, and this must never be forfeited in our enthusiasm to remedy the underlying pathological process.

Drug medication in most instances is not specific—its value is only a percentage of the whole—therefore the medicaments should be carefully selected and given in the simplest combinations possible. Usually it is well to recall that careful hygiene, suitable climatic changes, proper rest, efficient nursing, the resistance of the tissues against the enemy, disease, and in many instances the self limit of the ailment, exercise an important function in the recovery of our patients.

(c) PUTRID BRONCHITIS.

The means adopted for treating this condition must have as an object the destruction of the agents responsible for the putrefaction. A difficult task is at once recognized since it is almost impossible to apply remedies sufficiently concentrated to destroy the enemies without doing injury to the mucous membranes. Inhalations are nevertheless often used with fairly good results. Carbolic acid in two per cent. solution, turpentine and creosote are the drugs most frequently used. The method of the vaporization will be found under treatment of bronchiectasis. During the inhalations care must be exercised to protect the eyes, face and ears by the use of proper masks. Internally creosote, guaiacol and terpin hydrate are serviceable.

General hygienic and supportive measures include climatic changes, rest cures, good food and tonic drugs when indicated.

(d) SPIRILLAR BRONCHITIS.

Spirillar bronchitis is endemic in India. It was found by Castellani in Italian soldiers. He gave to it the name of broncho-spirochætosis. Careful observers have recently reported its presence in other European countries; that it is quite prevalent in the United States seems probable.

There is no doubt that this disease, due to a specific spirillum, has been geographically transplanted by the free intercommunication of nationalities during the Great War. Since the disease is due to a specific organism, the usual measures observed in infectious diseases should be adopted. The hygiene of the mouth should receive special attention. A gargle and mouth wash containing iodine, potassium iodide and glycerine possesses almost specific properties.

When acute symptoms develop, confinement in bed and a light diet suggest themselves.

Neoarsphenamin or arsphenamin when given intravenously is considered specific by most observers.

Farah used intramuscular injections of iodine with good results. It was based on the fact that fowls after the injection of iodine do not contract spirochætosis common to them when bitten by ticks. He also gave calcium chloride to those suffering from pulmonary bleeding.

Some of the dental fraternity recommend the daily local application of a 1 per cent. solution of mercuric cyanide and later a substitution of a 1 per cent. solution of chromic acid in individuals having an oral involvement.

(c) FIBRINOUS BRONCHITIS.

This is a rare disease and fortunately so, because the treatment is most unsatisfactory. Those remedies which have the power to dissolve casts are especially employed—*e.g.*, inhalations of lime water either pure or half strength, or a two to five per cent. solution of bicarbonate of soda. The timely use of apomorphine or ipecac as emetics may prevent the plugging of the bronchi with a cast. Expectorants may be used to advantage. Potassium iodide 0.6 to 1.0 gram (10 to 15 grains) is the best internal remedy—mercurial ointment freely applied is sometimes of service.

ii. Bronchiectasis.

Prevention.—The disease is always secondary to some other pulmonary condition. It may be so mild in the early stage that it is entirely “missed” diagnostically on account of the more obvious primary disease. Only in children can a true prophylaxis be approached. If the state is suspected, even though no physical signs are present, the treatment is simplified and by action against the underlying cause a cure can be expected. If the bronchiectasis has developed, a knowledge of the pathological process precludes the hope of a cure. The same climatic and hygienic measures as already noted under bronchitis must be adopted. Climatic changes are not to be regarded as curative or even prophylactic, but as an aid to the symptomatic treatment to be outlined.

Symptomatic Treatment.—The general nutrition of the individual must be maintained with food varied, liberal and nutritious. Alcohol is to be given to those subjects requiring it—the aged patients or those who have been or are habitual users. The objects to be remembered in undertaking the care of these patients may be summed up under four headings *viz*: 1. Lessen the secretion and remove it. 2. Relieve the fetor. 3. Protect the mucous membranes from irritation. 4. Attempt to lessen the size of the dilatations.

Syrup of the iodide of iron—1.0 to 2.0 cc. (15 to 30 minims) three times daily is a superior remedy to combat the exhausting effects of the catarrh. Other preparations of iron, as well as arsenic, quinine, cod liver oil and combinations containing calcium may be employed. Long before consulting the medical adviser, patients often discover the value of posture in securing relief from the cough and the expectoration. Different attitudes are assumed by the sufferers. These, of course, depend upon the positions of the dilatations. Expulsion may be easiest by lying down, turning to one or the other side, or simply changing the sitting posture. The continual postural treatment is occasionally employed. The patient is confined to bed, lying flat upon the back, with a pillow placed under the head and neck,

for an indefinite period, depending upon the results obtained. The foot of the bed is elevated 12 to 14 inches. This causes the fluid to collect in the bronchi by gravitation, and the irritation results in cough which secures the desired expulsion. The intermittent postural method has the same object in view, but the patient assumes the position during the sleeping hours only.

If syphilis is suspected, even though the various laboratory tests give negative findings, arsphenamin and mercury may be tried. To lessen the fetor inhalations of vapor impregnated with turpentine, thymol, eucalyptus, menthol, carbolic acid, oil of pine, and creosote are remedies especially recommended for intratracheal injections. When these preparations are used especial care must be exercised to protect the eyes, nostrils and ears. Internally, turpentine, guaiacol, copaiba, tar and creosote may be given, but it must be remembered that these individuals must not have an already disordered digestion intensified by the use of remedies given to aid the pulmonary condition. Surgical intervention has proved curative in some cases and must therefore be considered. It has for its object the destruction of the cavity by removing one or more sections of overlying ribs, permitting the chest wall, by retraction, to obliterate the dilatation.

An artificial pneumothorax has been produced by a number of observers with a view to lessening the size of the cavities but it is not to be recommended since the varying number of cavities and the marked induration always present preclude the possibility of favorable results.

Jex-Blake,¹ in reporting 567 cases of bronchiectasis, says "the medical treatment aims at combating the infection in the bronchial tubes by antiseptics, the most widely used of which is creosote. The creosote may be administered in three ways: 1. By the mouth, in capsule form; absorbed from the alimentary tract, some of the creosote is excreted into the lungs and may there act as an antiseptic. (He has never seen much good result from this mode of treatment, and it has the disadvantage of tending to upset the stomach). 2. By intratracheal injection; creosote, thymol, menthol, or some other organic antiseptic, dissolved in five or ten parts of olive oil, is injected into the trachea through the curved nozzle of a syringe, below the vocal cords, after cocaineization of the pharynx and larynx. A few drachms of the oily antiseptic can be introduced thus daily, in the hope that some of it will gravitate into the dilated tubes and help to sterilize them and their contents. (Here, too, he says, the treatment has not proved strikingly successful). 3. By inhalation; up to a point this method gives admirable results, of a palliative order. The creosote, mixed perhaps in equal parts with eucalyptus oil and *oleum pini silvestris*, may be given on a Burney Yeo inhaler, worn for many hours a day. A more effective method of administration is to have a small closed chamber in which creosote can be volatilized by heat; the patient, his eyes protected from the pungent vapor by goggles, inhales the white clouds of creosote fumes deep into his lungs. The fumes bring on violent coughing which empties the dilated tubes, and no doubt also exert a beneficial antiseptic action on their infected and inflamed

¹ Brit. Med. Journ. May 1, 1920.

walls. A creosote vapor bath can be given daily, at first for five minutes only, but after practise, for fifteen or twenty minutes; care should be taken to see that the fumes are not too strong, and that the creosote is not carbonized by overheating the dish from which it is evaporated in the creosote chamber. The benefits to be expected from this treatment are a great reduction in the quantity of the sputum, which often falls from 30 ounces a day to 2 or 3 ounces; loss of its offensive odor; diminution in the patient's fever; and much improvement in his appetite and general condition. But in the great majority of cases it is palliative only, and relapse is likely to follow its discontinuance."

iii. Tracheobronchial Stenosis.

This is essentially a secondary condition, therefore the means used to relieve it must be directed at the primary disease; if a medical one, the reader is referred to the proper description in this volume; if a surgical condition, a surgical treatise should be consulted. From this brief explanation, the importance of determining the causal factors, if success in any modification is to crown the effort, can be readily foreseen. It should not be considered inopportune to enumerate a few of the commoner causes under three separate headings:

1. Bronchial asthma and angio-neurotic œdema—functional obstruction.

2. Obstructions from within the "tubes"—endotracheal or endobronchial—tumors, exudates and transudates, inflammations, cicatrices, granulomata and foreign bodies.

3. External influences—pressure—intrathoracic goitre, enlarged thymus, pleural and pericardial effusions, mediastinal tumors, enlarged lymph glands, gumma and aneurism.

iv. Bronchial Asthma.

A new thought has recently been introduced which differs so radically from the views formerly held responsible for bronchial asthma that a knowledge of the possible or actual causes must be fully understood before intelligent treatment can be instituted.

For convenience of differentiation, two types are adopted:

- (1) True or typical bronchial asthma.

- (2) Asthmatic bronchitis or atypical bronchial asthma.

A foreign protein causes a contraction of the muscular tissue in true bronchial asthma by acting as a central or peripheral irritant upon the constrictor fibres of the vagus supplying the bronchial tubes. The stricture prevents a normal respiratory cycle. Since the muscles of inspiration are stronger than the expiratory muscles and the elastic tissue of the lungs, there is an interruption of expiration by inspiration before the former is completed. This finally causes an overdistention of the lungs with residual air and renders inspiration more difficult but less so than expiration.

This mechanical condition readily accounts for the distressing subjective symptoms and the physical signs so conspicuous in asthma.

Brodie and Dixon have carried on an extensive animal experimental investigation and have, by stimulating the constrictor fibres of the vagus by varied irritants, produced symptoms and physical signs similar to a typical asthmatic seizure. It is not understood why an initial dose of protein should render a patient susceptible to a second dose when the interval between administrations is sufficiently prolonged, but it is known that a phenomenon, anaphylactic shock, is produced by the meeting of the specific antigen of the second dose with the antibody resulting from the original dose. The primary dose rendering this reaction possible is known as the sensitizing agent. The reaction is called anaphylaxis. Sewell has shown that guinea-pigs sensitized to a protein may react to the intranasal instillation of horse serum by giving a typical picture of bronchial asthma, but it is still undetermined whether the whole protein, a toxic product of the protein, or the toxic agent, produced when the protein meets its antibody, is responsible for the irritation of the constrictor fibres of the vagus. It should not be considered amiss if a few of the great number of possible proteins are mentioned, *viz*: feathers, cat hair, horsehair or dandruff; timothy, redtop and ragweed pollens; *streptococcus hæmolyans*, and viridians, *staphylococcus pyogenes aureus* and *albus*, *micrococcus catarrhalis*, diphtheroid bacillus and the pneumococcus; commonly used foods such as eggs, milk, cereals, potato, wheat, corn, fish and chicken. Other foods or proteins may be suspected if the history is carefully dissected for possible causes.

Protein sensitivity may be determined by (1) the intradermal or intracutaneous injection or by (2) the cutaneous or skin test. The latter is less delicate but quite reliable. It is performed by making a number of cuts about 0.5 cm. long with a sharp scalpel on the flexor surface of the forearm. The skin is penetrated but no blood should be drawn. A drop of the suspected protein is placed on each cut and a drop of tenth normal solution of sodium hydroxide is added to dissolve the protein and permit its rapid absorption. Wash off the protein at end of a half-hour and note the reaction by comparing the inoculated areas with the normal controls on which no protein was used. If there is a positive reaction an urticarial wheal or raised white elevation about the cut will be disclosed.

Asthmatic bronchitis is usually associated with respiratory infections, hence cannot be called a true asthma. Its treatment, however, will be considered under that of asthma since the advances thus far made have not sufficiently impressed the medical fraternity; a majority will not accept a complete divorcement of these two entirely different conditions with no etiological relationship. It is so frequently associated with infection that a number are here recorded—catarrhal condition of the nose and throat, either with or without anatomical variations or pathological changes, infections of the sinuses, teeth or tonsils, acute colds, and bronchitis of the acute or chronic type. Not infrequently infections which are causative may be

found in remote regions of the body. Proteins cannot be charged with causal responsibility, the protein of the bacteria present excepted. The symptoms are usually due to the primary disease.

Other factors acting directly or indirectly as causative are recorded in description of asthma, Vol. II.

Preventive, Hygienic and Dietetic Treatment.—Since the factors responsible for sensitization are yet unknown, the prevention of typical asthma is hopeless, but if the causal proteins are shunned a recurrence of the asthmatic seizure may be forestalled. The prophylactic measures here enumerated are especially applicable to asthmatic bronchitis, but are useful in true asthma when complications arise or when desensitization is not secured for obvious reasons.

A painstaking inquiry as to the possible exciting causes may suggest the means to be adopted. The subject should remove from an environment which is injurious. Emanations from plants, bedding, feather pillows and the cat and dog are often exciting causes. Therefore contact must be avoided in non-tested, or non-desensitized individuals. A change of occupation is not infrequently advisable when the malady is exaggerated by unhygienic surroundings, or is producing the asthma. It has been fully demonstrated that bakers, millers, hostlers, wool and shoddy workers, hat makers, and weavers, etc., have suddenly developed asthma by becoming sensitized to some protein with which they have been in intimate daily contact for years. Of course, here again desensitization is the ideal treatment but, as most physicians know, it is sometimes impossible of realization.

Careful hygiene is of the utmost importance when the individual's physical condition will permit; in other words, those asthmatics not too debilitated by the disease. Cold bathing is advisable. Abundant fresh air in the sleeping quarters is essential. Exercise in moderation is to be encouraged, but fatigue must be avoided.

The diet should be regulated. Most clinicians advise against a hearty evening meal and if it is taken, suggest that sufficient time be allowed for its digestion before retiring. Those foods likely to cause flatulency are to be shunned, and some eminent authorities advise a partial or complete exclusion of meats from the diet. The function of the bowels should be regulated.

A full and careful physical examination will frequently reveal the underlying cause. The removal or correction of the etiology will prevent future attacks. A few etiological agents are here recorded—nose and throat afflictions either anatomic or pathologic, carious teeth, diseased tonsils, ear infections, and foci of infection elsewhere in the body, deformities of the chest, diseases of circulatory apparatus, diseases of the gastrointestinal tract including gall-bladder disease, appendicitis and hernia are not to be forgotten as reflex or direct causes. Diseases peculiar to the genito-urinary system must likewise receive consideration.

Climatic Treatment.—Individuals susceptible to pollen anaphylaxis should be desensitized against the specific protein accountable. When this

is impractical for reasons best known to the patient and the physician, seasonable changes are advisable. A residence may be established in a section free from the peculiar protein or an ocean voyage may be taken when financial resources permit. The sojourn should start before the offensive pollen season begins, and end after it has terminated. Typical asthma resulting from proteins other than pollens is not relieved by these climatic variations. However, those individuals suffering from an associated bronchitis or who are otherwise in ill health may be much improved by a change of climate. The atypical asthmatics are more benefited by regional changes than the true asthmatics. The localities enumerated under the treatment of chronic bronchitis may be adopted. Many other desirable settlements may be added to that brief list. It is peculiar but nevertheless true that a climate favorable to one individual may be non-beneficial or even detrimental to another. A city abode may be as good or better than a country one. A change of the home within a few miles or a few city blocks may have more merit than the shifting of it to some far distant health center. The best advice that a wise counsellor can give is, "the time and money consumed in the search for a suitable climate will hardly repay in physical improvement for the expenditure incurred."

Specific or Desensitization Treatment.—This plan of procedure will alleviate or cure about 80 per cent. of the cases of true asthma provided it is begun sufficiently early—that is, before complicating pathological conditions arise. However, it will not improve or cure the patient suffering from atypical bronchial asthma unless he has become sensitized to some protein—bacterial—which is intensifying the primary dilemma. The treatment embodies the desensitization of the patient to the specific protein to which he has been found sensitive. When the individual reacts to more than one protein, the one giving the most marked reaction should receive first consideration. Later, if advisable, the treatment may be directed toward the minor protein or proteins which produce reactions. A food responsible for the reactions may be banished from the diet.

It is well known that a patient may be able to take food prepared in one way but not in another—baked potato may be eaten with impunity, while a boiled potato may cause symptoms. Uncooked cereals not infrequently produce an anaphylaxis while those subjected to high heat may give no discomfort. Probably the high temperature destroys the protein's anaphylactic powers.

The patient can often absolutely avoid contact with proteins which are not commonly encountered in every-day life—feathers, wool and the hair and fur of wild animals.

The determination of the specific protein requires perseverance on the part of patient and physician alike if a successful desensitization is to be accomplished. The diagnostic and therapeutic proteins can be readily secured from the up-to-date drug shop since they are now prepared and marketed in suitable convenient containers by a number of the large pharmaceutical companies.

The skin test for fixing anaphylactic responsibility has been previously described. Skin or subcutaneous injections are made in varied dilutions to determine the amount of the initial dose, which is the strongest dilution failing to give a reaction.

The method of estimating the primary dosage is as follows:

A drop of the protein is placed on a fresh cut and a drop of 1-100 solution of sodium hydroxide is added to dissolve the agent and to facilitate rapid absorption. At the end of a half-hour period this is washed off and if a wheal appears, a series of tests are made in a similar manner until the protein and its solvent give a negative result. In each succeeding test the protein is diluted ten times as much as its immediate predecessor.

The dilutions may read 1-100; 1-1000; 1-10,000; 1-100,000; 1-1,000,000. The 1 represents the protein, the 100 its dilution.

The minimal hypodermic dose is 0.1 cc. of the first dilution failing to give a reaction. The treatment is given every seven days, increasing the dosage 0.1 cc. at each injection until 1.0 cc. is given in one dose. When the above maximal dosage of the first dilution is reached, 0.1 cc. of the weakest solution producing a reaction is given, and its dosage likewise increased at the weekly treatments until 1.0 cc. of this dilution is given. This process is continued, using in order the next stronger solutions until the patient is able to take large doses of the strongest solution without having anaphylactic shock.

People who are subject to bronchial asthma from animal emanations can usually be successfully treated by the above method, especially those sensitive to the usual dilutions, 1-10,000 or 1-100,000. The animals against which desensitization is practised are the common domestic cat, dog and horse. An improvement after four or five doses is frequent, but sometimes double this number are required before any benefit is noted.

Those individuals subject to pollen proteins are tested and treated in a manner similar to that described above. The dilutions are not as great, however. The treatment should be given previous to the pollen season. If a patient reacts to other proteins, the pollen should receive first consideration.

When bacterial proteins are offenders autogenous vaccines of the particular organism are made and administered. A minimal dose—say 200 million—is most frequently given and care must be exercised in administering the larger succeeding doses so that no marked reaction occurs. If these precautions are taken and a reaction results, the same dosage as the one giving the reaction should be repeated before the next larger dose is injected. Of course it must be remembered that vaccination can do no good as long as the primary focus exists, hence if a surgical condition is present, it must be removed.

Inoculation of food proteins by hypodermic methods will produce desensitization but it is a prolonged as well as a most difficult task. Several careful and painstaking investigators have succeeded in desensitization by feeding pills of the offensive protein. Here too the dose is guardedly and successively increased until the patient is able to take large amounts without the production of symptoms.

The most promising results are obtainable in young children whose parents are intelligent enough to foresee the advantages of producing desensitization. Then, too, most cases of asthma occurring in young children are due to protein anaphylaxis and, therefore, more can be promised for the effort expended, which is an added incentive for guarded care.

Peptone Treatment.—This plan of treatment has recently been advocated by Gow¹ and Auld.² It consists of the intravenous use of peptone in ten per cent. solution. The patient is confined to bed for twenty-four hours before the injection. A mild aperient is given the evening before, so as to lessen the nausea and vomiting so common, at least after the first dose. The breakfast should be light and treatment given in forenoon so that the discomfort may subside before the night.

The peptone, 5 to 6 cc. of the ten per cent. solution, is injected very slowly into a vein of the arm through a No. 28 or 30 needle. The dose is gradually increased. The nurse stands watch, constantly observing the pulse and calls out the number of beats each quarter. If this exceeds 35 per quarter the injection is temporarily stopped. The number of injections varies, but these observers have had, in some cases, marked improvement in five to seven injections and apparent cures in ten to twelve.

The peptone is introduced into the spinal muscles in children in the same dose as for adults, but in double concentration.

Treatment of the Attack.—These patients usually assume an upright or sitting posture with the elbows resting upon the arms of a chair. This position aids the accessory respiratory muscles. An abundance of fresh air in the room will permit easier breathing. Morphine, by hypodermic, is the most efficacious drug for the relief of the attack. The relief is usually immediate, but caution must be exercised in its use in order that the patient does not acquire the morphine habit.

The subcutaneous injection of atropin in 0.0006 to 0.0008 gram ($\frac{1}{100}$ to $\frac{1}{75}$ grain) doses is a remedy well supported by clinical results. It may be given alone, or combined with morphine.

Chloral hydrate, 1.0 gram (15 grains) will often relieve an individual attack but its likelihood of depressing the circulatory apparatus must not be forgotten. At the onset of a paroxysm, sodium bromide united with chloral may be given as a sedative.

Epinephrin solution, 0.6 to 1.0 cc. (10 to 15 minims), introduced into a muscle will, in suitable cases, give almost immediate relief. Repeated injections in free dosage, however, have been found to cause arterial degeneration. Caffeine or coffee, alcohol, hyoscyamus and pilocarpin are of less value but may be of some use in a few cases.

Cocaine is a valuable local remedy. Its habit is easily formed, hence it must be cautiously used. It is painted on the mucous membranes or inhaled as a fine spray from an atomizer.

¹ Brit. Med. Jour., Feb. 28, 1920.

² Brit. Med. Jour., Apr. 24, 1920.

Useful drugs available for inhalations are chloroform, iodic ether and amyl nitrite. The first named is extremely valuable in severe cases, but its action is transitory and the attack may reappear as soon as the drug stupor wears off. Many sufferers praise the different cigarettes and smoke-producing powders sold as patented remedies in the drug shops. They possess medicinal value which is obtained from the nitrate of potassium or the stramonium leaves in their composition. The same results are secured by using cigarettes made of stramonium leaves; or the fumigation may be obtained by dipping unsized paper in a concentrated solution of nitrate of potassium, drying and burning it when the attack appears. Patients will often seek a small room in which to burn the powder or papers, realizing that the atmosphere can be more quickly saturated—a croup tent is sometimes employed.

Interval Treatment.—Potassium iodide not infrequently possesses almost specific powers when the causal condition is irremediable. A rapid improvement is noted, even a permanent cure occurs occasionally. The dosage should be 1.0 to 3.0 grams (15 to 45 grains) per diem, continued for a prolonged period if any permanent benefit is to be derived from its use. The substitution of the syrup of hydriodic acid for the potassium iodide is worth a trial if the latter is not well tolerated.

Arsenic is frequently used in the treatment of asthma. Fowler's solution is the preparation most often prescribed, and should be given with interruptions for months. It is sometimes given in combination with potassium iodide.

Nux vomica in increasing doses gave Musser more satisfaction than any other remedy. He ordered 20 drops of the tincture three times a day and increased it 5 drops every three days until the point of tolerance was reached. He then decreased the dosage 10 or 20 drops and continued the treatment for an indefinite period. After a time, the dosage was again increased, so that the amount of nux vomica held the patient just below the saturation point. We have used this plan of treatment in several cases with gratifying results. The dosage for children is necessarily small, while adults have been found able to take 45 to 80 drops at one dose.

Benzyl-benzoate—one of the newer preparations—has been extensively used in the treatment of asthma, and although advocated by many eminent men, we do not find it possesses the merits awarded to it.

Iron and cod liver oil should be given to those individuals whose physical condition requires their administration.

Electric incandescent light baths have been quite successful in Strumpell's experience. The time allowed for the first treatment is fifteen minutes, while the succeeding daily ones require twenty-five to thirty minutes. The electric baths are followed by a warm tub bath, after which the patient is required to rest for two hours. He observed improvement after four or five treatments and an apparent cure after three weeks.

Compressed air treatment has many advocates, especially among European physicians. This procedure like Strumpell's must be carried out in well-equipped institutions.

Thymic asthma is caused by the pressure of an enlarged thymus and, when present, surgical measures must be adopted. The thymus may be completely extirpated or else so placed that it will not cause respiratory embarrassment.

The x-ray has been of service in a few reported cases. Radium is another agent which may have beneficial therapeutic qualities.

It is to be hoped that endocrinology will reveal the cause of the enlargement and present some organic therapeutic agent.

V. DISEASES OF THE PULMONARY TISSUE.

C. H. TURNER.

i. Congestion of the Lungs.

Two forms are here considered, *viz*: active and passive congestion.

The former is correctly regarded as symptomatic, present to a greater or lesser extent in all pulmonary infections, which include pneumonia, tuberculosis, bronchitis and pleurisy as the important offenders. It also occurs from increased cardiac action or from the inhalation of hot air or irritating gases.

The latter may be inspired accidentally or inhaled from an atmosphere intentionally vitiated with poisonous chemicals, as was practised in the Great War.

Treatment.—Immediate measures must be instituted to overcome the pulmonary congestion. If cyanosis is pronounced, withdraw 500 to 800 cc. of blood from a vein of the arm. In those subjects whose physical status will not permit therapeutic blood letting, dry cups can be applied to the entire chest. If the patient survives the initial stage, the succeeding plan of treatment is determined by the disease which is responsible for the condition and the remedies do not differ from those recorded under appropriate headings.

(a) PASSIVE CONGESTION.

From the causation of this condition, two forms, mechanical and hypostatic, may be recognized. The former is always the result of an obstruction which prevents the return of the blood to the heart. Usually the left heart is involved. The congestion is not infrequently produced by pressure upon the lungs by tumors. However, no discomfort may become manifest if the collateral circulation is sufficiently compensatory; but when the heart action becomes enfeebled, the accompanying engorgement is responsible for the bothersome and discomforting dyspnoea, cough and expectoration.

(b) HYPOSTATIC CONGESTION.

This form of congestion, as its appellation would signify, is influenced by gravity in individuals whose cardiac action is enfeebled by fevers and the adynamic states.

Treatment.—This depends upon the causal factors. Rest is of primary importance. Of course, a frequent change of posture in very ill persons and in the aged is desirable. The therapeutic measures are directed toward cardiac decompensation responsible for the pulmonary congestion. Digitalis or strophanthus in appropriate dosage are the drugs most useful. Hoffman's anodyne and strychnine may be given when indications require their administration. Dry cups, applied over the base of the lungs posteriorly, may be tried. Free purgation will do good in patients whose physical condition is not harmed by it.

(c) PULMONARY ŒDEMA.

This condition is most frequently the terminal event in cardiac, renal, respiratory, and the infectious diseases. No matter which of the above may be causative, active measures should be immediately instituted. Particular attention must be given to the relief of the pulmonary circulation. In severe cases a withdrawal of 200 to 400 cc. of blood by venesection is very efficacious. When the tension is high, vasodilators are indicated, *e.g.*—nitroglycerine 0.0006 to 0.001 gram ($\frac{1}{100}$ to $\frac{1}{60}$ grain). Dry cupping over the entire chest should be practised. Atropin sulphate 0.0006 to 0.001 gram ($\frac{1}{100}$ to $\frac{1}{60}$ grain) by hypodermic, repeated at infrequent intervals, is commonly recommended and deserves thorough consideration even though it is a vasoconstrictor. Morphine may be given to quiet the nervous irritability. Digitalis, strophanthus or other cardiac stimulants may be administered when this line of treatment is demanded. The use of oxygen must not be forgotten, but will seldom do good except in those cases where foam is present in the alveolar spaces. Oxygen is most salutary in this condition, converting the foam into oxygen foam. However, if there is simply a layer of moisture, oxygen will do no good.

(d) PULMONARY HEMORRHAGE-HÆMOPTYSIS.

Blood-spitting will be considered as meaning the expulsion of blood from any part of the respiratory tract independent of quantity ejected. The term "hæmoptysis" should really be applied to blood coming from the bronchi or lungs. It is probably desirable to recount some of the commoner causes so that a better knowledge may be had of reasons for treatment outlined. Pulmonary tuberculosis is the cause in a large percentage of cases. Among other causal agents the following may be mentioned: ulceration of larynx, trachea and bronchi, inflammation of lung tissue in early stages of acute diseases, bronchiectasis, emphysema, abscess or gangrene of the lungs, pulmonary infarct, malignant growth, trauma either

to chest from without or injury from within by the presence of foreign bodies in the lungs, diseases of the heart and likewise those diseases which have hæmorrhagic tendencies.

From the above the reader will readily see the necessity of finding, if possible, the cause of the blood-spitting and of directing the remedial treatment toward the underlying condition. This materially simplifies the work to be done.

Symptomatic Treatment.—When bleeding occurs, rest is absolutely essential and in no place can this be better obtained than in bed. If the patient is bleeding he is probably frightened; therefore it is well to quiet the mental anxiety by cheering words, assuring him that in all likelihood the attack will soon subside. Pieces of ice may be rolled in the mouth and the water swallowed. If the action of the heart is tumultuous, an ice-bag should be applied to the chest and injections of nitroglycerine in proper doses administered. When the bleeding is in the least alarming, morphine 0.015 gram ($\frac{1}{4}$ grain) should be immediately given by hypodermic. This will allay the irritable non-productive cough, quiet the nervous system, relieve the fear, and slow the pulse. Calcium may be tried, but it is of doubtful value—it surely cannot be expected to prove useful if bleeding is the result of an erosion of a blood-vessel. The injection of serum is sometimes employed but its therapeutic adequacy is questionable. Thromboplastin in bleeding is recommended by some. The internal use of ergot, atropin, epinephrin and pituitary extract is therapeutically and clinically harmful. An artificial pneumothorax is to be considered as a most efficient remedy when the hemorrhages are frequently repeated. The lesion must be definitely localized and the possibility of pleural adhesions debated, before this means of combating the bleeding is adopted. Finally, careful nursing is of prime importance.

Pulmonary Infarct.—In pulmonary infarct, the hemorrhage comes from a congested cone-shaped mass in the lung tissue. The treatment consists of rest, reduction of blood pressure by a minimal diet, if necessary, purgation, and the hypodermic administration of morphine. When abscess, gangrene, pleural effusion or empyema occur, they are to be treated in accordance with the respective indications. Small infarcts are difficult of clinical recognition and require no special treatment.

ii. Diseases Characterized by Changes in the Vesicular Structure of the Lung.

(a) PULMONARY EMPHYSEMA.

Emphysema is only slightly responsive to treatment; therefore the therapeutic measures must be directed toward the chronic bronchitis which is answerable for most of the symptoms. Those agents recorded under the treatment of chronic bronchitis are applicable, and do not need repetition. Asthma and hay fever must be remedied and their recurrence, if possible,

prevented. Infections of the nose, throat and paranasal sinuses must be corrected. Protection from dust and exposure to weather are important. A change of climate may be advised.

Some few clinicians have reported prompt and remarkable relief in a number of cases from section of the costal cartilages. This is especially suitable when the condition seems to be primarily due to abnormal rigidity of the chest wall, as is not infrequently the case in young sufferers. Many ingenious means have been devised to relieve the dyspnoea and no doubt the beneficial results can be ascribed to an improvement in the pulmonary circulation.

Digitalis is the drug of election, when myocardial decompensation declares itself. A physiologically tested tincture is, without doubt, superior to any other preparation. Strophanthus may be used with equally good results. The doses and time of administration are determined by the urgency of the case under observation. When œdema develops, diuretic measures are to be instituted—spartein sulphate 0.015 gram ($\frac{1}{4}$ grain), acetate of potash 0.6 to 1.0 gram (10 to 15 grains), theobromine sodium salicylate 0.6 gram (10 grains), to be given every three or four hours during the day. The infusion of digitalis (freshly prepared from the leaves) is particularly useful in doses of 4 to 15 cc. (1 to 4 drams) in dropsy, dependent upon cardiac embarrassment or renal obstruction.

(b) ATELECTASIS.

Congenital atelectasis requires measures applicable in asphyxia. The nose and mouth of the new-born should be freed of mucus, and if necessary a catheter may be used to aspirate the fluids from the trachea.

The respiration should be stimulated by slapping the body, or by applying friction. Alternate immersion in hot and cold water will often aid. If these measures fail, artificial respiration should be practised. When breathing has been established external heat should be applied and all clothing should be free.

In acquired atelectasis the primary cause is the one demanding consideration. Foreign bodies should be removed. A change of position will often give relief.

Bronchial secretion should be removed by proper remedial agents. The early removal of a pleural effusion will permit reëxpansion of the collapsed lung; if long delayed, adhesions will prevent.

(c) BRONCHOPNEUMONIA.

Bronchopneumonia is essentially a secondary disease common to all ages when debilitated, but occurring most frequently at the extremes of life. In early life it is mostly associated with the acute infections of that period, while in old age it is the terminal event of some chronic disease. A few of

the causes are here enumerated so that the preventive measures can be more fully understood: measles, scarlet fever, diphtheria, pertussis, bronchitis, tuberculosis, influenza, sepsis, trauma from without or within, anæsthesia, and chronic diseases. In infants—malnutrition, gastro-intestinal diseases and rachitis are additional factors.

Prophylactic Treatment.—The ideal preventive treatment in most instances is impossible of realization because we have not as yet discovered the means of destroying or eliminating the causes. However, much can be accomplished if strict isolation of those afflicted with acute specific infectious diseases is rigidly enforced. No one not immune to the primary disease should be exposed. Anæsthetics should not be administered during an acute respiratory infection unless urgency demands.

Attempts have been made within recent times to immunize against broncho-pulmonary infections, and, while we do not doubt that some individuals are occasionally benefited and probably protected against some of the infective agents, we cannot as yet subscribe to this prophylactic measure without reservation. May we not hope, however, that further investigations will give us more reliable and dependable results.

General Hygienic and Dietetic Treatment.—The individual suffering from bronchopneumonia should be isolated and should be kept in bed. The latter, of course, has its limitations in infancy. The open air treatment—on roof or open porch—is used most frequently in hospitals and institutions. This is a valuable measure but is not suitable for every individual. In the home, the room should be well ventilated by open windows, but a screen should be used to afford protection against draughts. A flannel night-dress or pajamas should be worn. Tents and steam kettles are distinctly harmful from the oppression caused by the moisture. Poultices and “jackets” are objectionable on account of the weight and the heat.

The food should be liquid or semi-liquid and given at regular intervals in small quantities. When dyspnoea is marked it may be necessary to feed infants with a spoon or medicine dropper. The drinking of water in free portions is to be encouraged. As in any infection a free purgation, except in debilitated subjects, is indicated. Calomel or blue mass may be given at night and a saline aperient the morning following.

Symptomatic Treatment.—There is no specific for the disease. We have used the various bacterial serums and have never found them to possess distinct curative properties. The search for a specific vaccine will be found an almost hopeless task because of the multitude of organisms capable of producing the inflammatory process.

Hydrotherapy.—A moderate temperature requires no vigorous treatment since it may be considered nature's effort to inhibit the growth of the bacteria. When the temperature is persistently high—103° to 105° F.—warm baths, either sponge or tub, at stated three or four hour intervals, are desirable. The time for the bath must not be prolonged for more than five

to eight minutes. If cyanosis or weakness should occur, baths are contra-indicated, and, if begun, should at once be terminated. Cold baths have no advantage over warm baths. Sponging the body with alcohol, diluted with warm water, is often employed to reduce the temperature and secure quiet of the nervous system.

An ice-bag to the head is advisable, but some patients—children and infants—object strenuously to its use.

PAIN.—When the pain is severe, strapping of the chest is useful. Sedative drugs should be avoided but may be given when required. Opium is the one drug having a definite value.

COUGH.—Expectorant drugs are of value only in loosening the hard dry cough of the accompanying bronchitis involving the large tubes. As soon as a result has been secured all drugs of this type should be stopped, and especially is this true in children, where they may cause harmful results if continued. Ipecac, antimony and apomorphine are employed early, and ammonium chloride and potassium iodide in the later stages when secretion is thick and difficult of expectoration.

Sodium bromide or ammonium bromide may quiet the cough. Opium, heroin, codeine or morphine, should be avoided as long as possible when secretion is abundant, but when the cough is harassing and prevents sleep, their use is indicated.

Belladonna will relieve the cough when there is an excess of a watery bronchial secretion.

STIMULANTS.—This class of drugs should never be given until required. It is a deplorable practice to give stimulants as soon as the diagnosis is made, without first determining whether the case will be benefited or harmed by their use. It is best not to whip a "labored circulation" since the reserve may be much needed to make the final plunge "over the top."

Camphor, strychnine, caffeine, and atropin are very frequently employed, but it is questionable whether they ever do good. Atropin, however, has many good qualities to recommend it.

Digitalis may be given when there is evidence of auricular flutter or fibrillation, but otherwise we do not believe it to be of any real service whatsoever, and it has the disadvantage of disturbing the stomach. Tincture of strophanthus may be used in free dosage when signs of circulatory failure appear. Epinephrin chloride by hypodermic is an excellent drug, to be used for emergencies only.

Alcohol is a valuable stimulant, especially in very severe cases, and if we were asked as to the most efficacious drugs in the treatment of bronchopneumonia we would place opium at the head of the list, and alcohol would occupy a close second place.

When convalescence sets in, a change of air is the most valuable tonic that can be prescribed. The country, mountains or seashore may be selected. This depends upon the residence of the patient.

iii. Diseases of the Lungs Characterized by Interstitial Inflammation.

(a) INTERSTITIAL PNEUMONIA.

As long as the patient's health is much enfeebled, rest by an open window or in the open air in suitable weather is advisable. Of course, proper clothing should be worn. Improvement calls for the same climatic changes as prescribed for other chronic pulmonary afflictions.

The diet should be easily assimilable and nourishing. Tonics and alcoholic liquors are to be used when indicated.

Cough.—Mild sedatives—bromides, chloral, and benzyl benzoate—may be tried when the sleep is disturbed, but usually recourse to opium or its derivatives must be taken. The latter should be avoided as long as possible on account of the chronicity of the disease and the habit-forming possibilities of the drug.

Expectoration.—This may be controlled by the same drugs as used for chronic bronchitis and bronchiectasis. Inhalations of creosote, turpentine, etc., may aid in the expulsion or help through their antiseptic properties.

Dyspnœa.—This can be partially controlled by restricting exercise, and by the aid of suitable cardiac remedies if decompensation occurs.

(b) PNEUMOCONIOSIS.

There is no specific for this disease. Those subject to respiratory diseases should be cautioned against occupations which subject them to a dust-laden atmosphere. Delimit dust inhalation by proper precautions. When symptoms arise, advise abandonment of work and treat the bronchitis, the bronchiectasis and the myocardial insufficiency with appropriate measures. These subjects are covered under respective headings.

iv. Diseases of the Lungs Due to Suppuration and Necrosis.

(a) PULMONARY ABSCESS.

Some clinicians include pulmonary abscess and pulmonary gangrene under the term "pulmonary suppuration." This is an excellent appellation since they are closely allied in both symptoms and treatment.

The discharge of the suppurative contents will not infrequently result in a cure. When the abscess is loculated within the lung proper, or when it develops near the pleura, causing an empyema—and lung abscess is one of the common causes of pyothorax—surgical means of acquiring drainage are imperative. The site of the abscess may be determined by a careful physical examination and further verified with the help of the radiographer.

As in septic conditions elsewhere, active supportive measures are particularly advantageous.

An artificial pneumothorax has been recommended as a valuable therapeutic agent in the treatment of lung abscess. It has its limitations, however, on account of the peculiar pathological state of the pulmonary tissue.

(b) PULMONARY GANGRENE.

Spontaneous expulsion of the gangrenous material not infrequently produces a cure. However, pulmonary gangrene is usually a surgical condition, and therefore we must not prolong the expectant symptomatic treatment too long, lest irreparable damage result. Of course, a circumscribed gangrenous process is alone responsive to surgical treatment—the plan of attack can be found in a surgical treatise. While waiting for operative intervention, supportive measures must be observed. The cough demands attention and may be controlled by the same variety of sedatives recorded under the treatment of bronchiectasis and of chronic bronchitis. Inhalations of creosote are frequently tried and may be found potent in a few cases.

The patient will be obnoxious to those with whom he comes in contact, unless some deodorant is employed to destroy the foul odor of the sputum.

Carbolic acid, potassium permanganate and chloride of lime will be found quite reliable deodorizing agents.

v. New Growths of the Lungs.

Cancer of the lung is usually secondary to disease in some remote region or to cancerous invasion from a contiguous organ or structure; it may, however, be primary.

Sarcoma of the lung is most exceptional, and when present may be either primary or secondary.

No specific for either carcinoma or sarcoma has as yet been produced. A diagnosis should be made at the earliest possible moment, even in the pre-cancerous state, and surgical means employed to eradicate the primary focus in its entirety. The Röntgen ray may be used in conjunction with the operative treatment. Radium may alleviate suffering to a greater or lesser extent, retard the progress of the growth, and prevent some of the obnoxious qualities of malignant tumors. Coley's fluid is often used in sarcomatous conditions.

When the tumor has developed to such a state that the expediency of an operation is questionable, non-operative treatment is advisable and palliative remedies should be given.

PAIN is one of the most conspicuous symptoms demanding relief. Opium is the only drug of real value and should be given in free portions, in gradually increasing doses, and without considering its habit-forming possibilities.

COUGH.—Opium and its derivatives—heroin, codeine, morphine—are capable of giving some comfort if proper dosage is employed. The expectorant drugs are useless.

DYSPNŒA.—If due to lessened lung area, little can be done excepting for those having a pleural effusion or an empyema, when evacuation may give temporary relief.

Benign tumors are quite a rarity. They require no special consideration. The symptoms, which are dependent upon size, location and dysfunction of the part involved, should be treated in conformity with the rules promulgated for like symptoms occurring in other diseases.

Actinomycosis.—Although reported cures have appeared in literature, this is an extremely fatal disease. A specific treatment remains as yet undisclosed. Potassium iodide is the only drug possessing any worth-while therapeutic value. It should be given in full dosage—3 to 4 grams (45 to 60 grains) per diem. Surgery offers some hope for an infrequent cure or at least temporary improvement when the affected area is accessible for complete extirpation. Scraping may be employed instead of excision. The parts should in that instance be painted with silver nitrate, iodine, iodoform; or the Dakin solution should be used.

VI. DISEASES OF THE MEDIASTINUM.

C. H. TURNER.

Acute Mediastinitis.—This condition, when present, is often associated with acute inflammatory diseases within the thorax. It may result from the presence of foreign bodies. If the process is an extension from a diseased pleura, lung, bone or a tumor, those measures which were used to combat the primary disease are to be continued. This, of course, will require absolute rest in bed, a suitable nourishing diet, and the employment of the proper remedies to relieve the pain when present. When due to a septic condition, quinine and alcohol have therapeutic qualities not to be overlooked.

If a foreign body has lodged in the œsophagus or in some part of the pulmonary tube, it should be removed as soon as possible by a specially trained operator. If suppuration or gangrene occur, the surgeon should be consulted at once. The reader may consult a surgical text-book for an understanding of the means he is likely to recommend.

Chronic Mediastinitis.—Treatment will have no direct influence upon this pathological process. The symptoms as they arise demand attention. The cardiac action must receive special attention, and when symptoms appear, general and special principles must be observed and employed as for like symptoms in other forms of cardiac involvement. Should fluid accumulate, its removal is paramount. Surgical measures may be indicated in isolated cases.

New Growths.—The remedies used are, in most instances, of a palliative nature. This is especially true if the growths are malignant. However, when syphilis or tuberculosis is causal, much can be done if the appropriate treatment for these morbid processes is used. The symptoms require the

same general and special measures as for similar symptoms in other conditions. This has been very fully covered in previous articles where like symptoms occur, and it is not deemed necessary to repeat them.

Surgery not infrequently seems advisable—thoracotomy to relieve pressure, and aspiration or incision, with or without rib resection, to remove fluid. Excision is rarely possible.

VII. DISEASES OF THE PLEURA.

C. H. TURNER.

i. Pleurisy.

The anatomical classification—dry or fibrinous pleurisy and exudative or pleurisy with effusion—is adopted arbitrarily for convenience of description.

(a) FIBRINOUS OR DRY PLEURISY.

Preventive Treatment.—If reference is made to the etiology it will be found that the tubercle bacillus is the infective agent in 70 to 80 per cent. of all cases. The pneumococcus and the streptococcus rank next in order as offenders. The pathological process is not infrequently secondary to some contiguous or remote disease; therefore, a careful search must be made to seek out the primary focus and if possible, correct or destroy it. This brief resumé shows that the prophylactic measures must be directed to the primary disease. The description will be found recorded in chapters covering the respective subjects.

Symptomatic Treatment.—Absolute rest in bed, independent of the mildness or intensity of the symptoms, will have a profound influence upon the course of the disease. Pain is the chief symptom which induces the sufferer to consult the physician. Here our good friend opium, or some derivative of it—morphine, codeine, or Dover's powder—is the drug par excellence. When the pain subsides or is less severe, salicylate preparations in suitable doses may be substituted.

Local Treatment.—Dry cold in the form of an ice-bag or moist cold as a compress often gives relief when applied to the tender areas. Some individuals do much better when heat is used as the local remedy. The hot water bottle or the electric pad does admirably. Formerly dry cupping was frequently used, and although of doubtful value may still be tried in troublesome non-responding cases.

Limitation of the respiratory movement of the affected half of the chest by strapping, when properly applied—extending the adhesive plaster beyond the middle line anteriorly and posteriorly—will at times quickly give freedom from pain. Strapping may, however, intensify the pain in the diaphragmatic form of pleurisy by increasing the movements of the organ. In that variety it is best to apply a firm abdominal bandage.

(b) PLEURISY WITH EFFUSION.

Prevention.—The progress of the infection may be retarded in its incipiency by absolute confinement in bed. The rest increases individual resistance and secures freedom of motion for the diseased membrane. The diet should be a light one which can be easily digested. It may be made salt free. Milk is the only liquid which is allowable in rather free portions. A saline purge is advisable. Unfortunately, there is no specific remedy; however, if the etiology is ascribed to a rheumatic infection a salicylate may be tried.

Symptomatic Treatment.—The symptoms of the early stage require the same treatment as recorded under that of fibrinous pleurisy; minimizing the fluid intake is often attempted with a view to arresting the accumulation. Free catharsis may be used at the beginning but should not be continued on account of its depressing influence. Diuretics may be advantageously used, theobromine sodium salicylate, Basham's mixture, potassium acetate, or theocin. Cardiac stimulation is to be used only when decompensation asserts itself. The iodides, agents formerly prescribed very extensively, have no place in the armamentarium, and if the condition is of tuberculous origin, are absolutely contraindicated.

Paracentesis.—This is the remedy of choice, but not all cases require it. It is most efficient for the alleviation of the symptoms, withdrawal of fluid and correction of condition. The indications for its use are time-honored: (1) Massive fluid accumulations dangerous to life in either acute or chronic cases. (2) The presence of dyspnoea independent of the quantity of fluid. (3) Slow or non-absorption of exudate.

Time of Tapping.—When the effusion is not causing alarming dyspnoea or marked pressure symptoms, it is best to await abatement of the acute stage with cessation of fever before any attempt is made to remove it. Probably the time of election is ten to fourteen days after the development of the effusion. No fast rule can be made, however. When the fluid is rapidly rising and has reached the level of the third rib anteriorly or the scapular spine posteriorly, if life is to be saved immediate puncture should be done irrespective of untoward symptoms. The tapping of a tuberculous effusion should be performed late, if at all, because the adhesions and the lung atelectasis favor the defensive tuberculous infiltrations.

Site of Tapping.—When tapping is decided upon, the site chosen should be as low as possible over the area of flatness. As a rule, the sixth or seventh space in the mid-axillary line is selected because of the thin wall and wide interspaces. Occasionally, when the fluid does not reach far anteriorly, the seventh or eighth space near the scapular angle is chosen.

The x-ray is a valuable precision instrument for the location of site of puncture in loculated or encapsulated effusions. More than one puncture should be made when a dry tap results, before the diagnosis is condemned. A thickened pleura or a loculated fluid may have produced the embarrassing dry tap.

Technic of Tapping.—Thorough asepsis, as for other surgical operations must be practised; the instruments used thoroughly boiled; the physician's hands aseptically cleansed; and the site washed with soap and water and cleansed with alcohol. Tincture of iodine may be painted over and about the puncture site. The patient should be placed in the recumbent posture, either upon the side or upon the back, with shoulder raised upon affected side. Some clinicians prefer the sitting posture with elevation of the extremity on the diseased side. The latter is more convenient for the operator but attended with danger to the sufferer. The part may be desensitized to pain by the use of some local anæsthetic—procaine, cocaine, ethyl chloride or ice. None are quite efficient unless the pleura is likewise anæsthetized. Some operators use no local anæsthetic, asserting that the pain is only momentary and causes no more discomfort than the anæsthetic used. A general anæsthetic is contraindicated. A hypodermic syringe loaded with a stimulating drug should be at hand for use, should emergency symptoms arise.

A medium-sized hollow needle (16 G, $3\frac{1}{2}$ ") with lateral opening is most often used. The needle is connected to a Potain aspirating apparatus by a rubber tube. A vacuum is created in the collecting bottle by an exhaust suction pump. The negative pressure is maintained by closing the stop-cock between pump and bottle. To be doubly sure that air has not been pumped into the bottle, the apparatus must be tested before using. This can be done by drawing sterile water or a normal salt solution through the aspirating needle.

The interspace is selected and the index finger of the left hand placed therein at the lower border of the rib, above which must be avoided on account of the position of the corresponding intercostal artery. The needle properly connected to the apparatus is plunged—inward and slightly upward along the upper edge of the rib below—into the pleural cavity. Open the stop-cock between the needle and the vacuum bottle, and allow the fluid to flow slowly, by suction, into the container. The quantity withdrawn will of course be dependent upon amount of fluid present. A maximum of not more than 1500 cc. should be aspirated at one tapping. If more exudate is present it is better to repeat the operation than subject a patient to the dangers attendant upon a too sudden change of intrapleural pressure by the radical removal of entire content.

Withdrawal of a minimum amount will often relieve distressing symptoms, and bring about a normal restitution of function with resorption of the remaining fluid.

Dangers of Paracentesis.—This is generally considered a very simple measure, not commonly attended with unfavorable symptoms; however, untoward symptoms may develop either at once or some hours or days after the evacuation of the fluid. These probably result directly from the influence the change of the intra-thoracic pressure from a positive to a negative one has upon the heart, the lungs and the latter's circulation.

Excessive Cough.—This may be prevented by a hypodermic of morphin and atropin given fifteen minutes before the puncture is made. If excessive cough develops during the aspiration, the operation must at once be stopped.

Hemorrhage.—This may result from injury to pleural membranes or from puncture of an intercostal artery.

If care is employed in introducing the trocar the latter can be avoided.

Infection.—Surgical asepsis will prevent direct infection from without. No control can be exercised over that originating from within.

Pneumothorax.—This may arise from a puncture of the lung or rupture of a softened tubercle. No treatment is required as a rule.

Pulmonary Œdema.—Prevent by slowly withdrawing fluid. If it develops stop and institute treatment for same.

Sudden Death.—This is the result of sudden collapse, embolism or some unexplainable condition.

Artificial Pneumothorax.—Wiel (1919) recommends producing an artificial pneumothorax in serofibrinous pleurisy by the injection of air and following the paracentesis. He claims that it prevents secondary complications and the troublesome adhesions. In a series of eighty-six cases he says where puncture alone was done 84 per cent. had marked secondary trouble within a few months, while in a second series of fifty cases, injection of air following the tapping, 82 per cent. showed recovery without adhesions. Those showing adhesions were of long standing before aspiration was executed. The Röntgen ray and the radioscope were used to control the treatment. One or more injections were required. As many as ten were given to one patient within one year, with a final cure. The treatment is claimed particularly favorable in tuberculous effusions, securing rest to the lungs and checking the progress of the tuberculosis.

After-Treatment.—When all acute symptoms have subsided the patient may begin "systematic lung exercises" even though still confined to bed. Lying upon the normal side will encourage expansion. The general condition of the patient should be strengthened by good wholesome food, a daily cold sponging of the chest, suitable tonic remedies, and if possible a sojourn to some climatic health center.

(c) EMPYEMA.

The reader should refer to a recent recognized surgical work on this subject. However, the fact cannot be disregarded that the primary disease was in all likelihood a medical one and that the diagnosis was made by the internist before the surgeon was called for operative advice. We shall therefore consider empyema a medico-surgical predicament and give some medical and surgical details of its management.

If in doubt as to the denomination of the imprisoned fluid, an exploring needle will unmask its true aspect. When tuberculosis underlies or accompanies this morbid plight, probably acuteness of judgment is demon-

strated when aspiration is practised at irregular intervals since the open plan of treatment releases the compression so essential for delimiting tuberculous extension.

It seems unnecessary to reiterate the treatment of the underlying cause; the same measures applied for the primary state must be continued with whatever modifications the changed aspect of the situation requires.

Hygienic, dietetic and supportive steps are not dissimilar to those used for purulent accumulations happening elsewhere.

The empyema commission of the United States Army recommends that aspiration be practised every other day until the pus will no longer flow through the cannula, after which thoracotomy is advised if the physical condition of the patient will warrant it. It gives several reasons why early operations in streptococcic empyemas are inadvisable and we take the liberty of abbreviating and recording them. (1) Lung collapse from pneumothorax. (2) The possibility of blood stream infection from absorption of streptococci from the fresh wound surface. (3) The desperate plight of the patient.

The treatment of acute empyema is aspiration, intercostal incision, or rib resection, depending upon the character of the exudate and the condition of the patient.

Aspiration of pneumococcal empyema in the early stage may be sufficient to effect a cure as the organisms quickly perish. Repeated aspiration of pleural effusions may be done until they become macroscopically purulent. Intercostal incision, or thoracotomy, is indicated when the patient is very ill and when the empyema is comparatively recent.

The patient lies in the recumbent or preferably in the prone position, close to the edge of the table. It can easily be done under local anæsthesia. If a general anæsthetic is employed nitrous oxide and oxygen is the best, chloroform may be used but ether should be avoided.

An incision from two to three inches in length is made along the upper border of the eighth or ninth rib in the posterior axillary line. The intercostal vessels are thus avoided and ligatures seldom are needed. Allow the pus to escape slowly, remove loose pieces of lymph, if present, and introduce a short rubber tube. This tube is prepared by cutting three-fourths of the circumference of a piece of rubber tubing about one-half inch in diameter bending the tube on itself, then inserting the incompletely divided end. Suture the tube to the skin and transfix with a large safety pin. Apply ample gauze dressings. The discharge is copious for the first few days, and dressings require frequent changing. After the third day Carrel tubes may be passed through the larger tube, two in each portion of the tube, and the Dakin Carrel treatment instituted. The cavity is puddled with Dakin's solution every second hour during the day, and every third hour during the night, the patient lying upon well side for twenty minutes after the instillation of the fluid. The larger tube is removed in from seven to ten days and the Dakin Carrel treatment is continued by passing two to

four Carrel tubes into the wound until there are three negative smears which usually can be obtained in from three to six weeks. Patients are not allowed to leave the hospital with a sinus. When the discharge begins to become scanty the skin and wound edges should be painted with iodine every second day to prevent reinfection of the cavity or sinus.

In the event of a bronchial fistula complicating empyema one must use the Dakin solution with great caution, or better desist until the fistula has become closed.

Thoracotomy with rib resection usually is performed under local anæsthesia. It is slightly more dangerous than thoracotomy without resection. Rib resection is supposed to afford better drainage and is indicated particularly in long standing cases where there may be pleural adhesions or large masses of lymph.

A three to four inch incision with its center in the posterior axillary line is made over the seventh rib, the periosteum is divided and freed from the entire circumference of the rib with a periosteal elevator or other suitable instrument. About two inches of rib is removed by a costotome or a bone cutting forceps. An incision is made through the reflected periosteum and parietal pleura, care being taken not to injure the intercostal vessels.

ii. Morbid States Characterized by the Transudation of Serum or Chyle, or the Eruption of Blood or Air into the Pleural Sac.

(a) CHYLOTHORAX.

The effusion may be either chylous or chyloform. The latter is seen in tuberculosis or new growths within the thorax while the former may result from (1) rupture of the thoracic duct by trauma, (2) pressure upon the major duct or upon the smaller lymph ducts by tumors, (3) thrombosis of the left subclavian vein, (4) disease of the lymph vessels, (5) parasites within the thoracic duct, (6) cancer of the pleura.

The treatment resolves itself into that of the determined cause, together with the removal of the fluid when marked embarrassment of the respiratory or cardiac systems or both occur. If trauma is responsible, evacuation of the fluid will often facilitate its early reaccumulation, therefore this plan should be delayed as long as compatible with good judgment. Strapping of the chest may delimit the collection. Surgery offers some hope in a few selected cases.

(b) HYDROTHORAX.

This is the result of venous stasis with a transudation of serous fluid into the pleural cavity or sac. It is entirely non-inflammatory, differentiating it from a pleural exudate which is a pathologic fluid resulting from the secretory activity of inflamed pleural endothelial cells. Hydrothorax is secondary to some other condition. Cardiac disease is the most common

cause. Renal disease takes second rank but when fluid is large in amount there is usually an associated cardiac decompensation. Diseases of the blood or some local condition make up most of the other causative factors.

If the condition is thoroughly understood it is readily seen that the treatment must be directed toward the primary disease, *e. g.*, heart, kidney, blood, etc. When fluid becomes excessive, causing marked pressure symptoms, a paracentesis must be done. The description of the technic for this procedure will be found fully covered under treatment of pleural effusions.

(c) HÆMOTHORAX.

Bleeding into the pleural sac results from injury to the chest, rupture of an aneurism, or from pressure of a tumor upon the thoracic veins. The treatment therefore belongs to the surgeon and the reader is referred to a surgical treatise. The surgical measures in trauma to the chest are usually conservative. Not much is to be gained by operative procedures in rupture of an aneurism.

(d) PNEUMOTHORAX.

Prevention.—Paracentesis is the only condition causing pneumothorax which is under the control of the physician. If due care is exercised in introducing the proper trocar, slowly withdrawing the effusion and cautiously removing the needle when severe coughing develops, this rare accident may be prevented. It is, however, sometimes intentionally produced for therapeutic reasons. Pneumothorax is so infrequent in tuberculosis that no attempt need be made to delimit respiratory movement.

Symptomatic Treatment.—No treatment is required as a rule in spontaneous cases. However, rest in bed and limited respiratory excursions are commendable and may prevent serious complications. If fluid accumulates, allow it to remain for a time before removing. When a pyothorax develops, a surgical condition presents itself, requiring operative treatment. Morphine may be given for shock, dyspnoea or bothersome cough. Various cardiac and respiratory stimulants may be needed.

XIII.

THE TREATMENT OF DISEASES OF THE KIDNEY.

SAMUEL BRADBURY.

I. ANATOMICAL ANOMALIES.

In clinical medicine the only anomaly of importance from the standpoint of treatment is the single kidney. Whenever it appears advisable to carry out any operative procedure upon the kidneys, it should be determined that there are two kidneys, and, if both are present, whether or not each kidney has good functional ability. This may be ascertained

by cystoscopy, catheterization of the ureters and measurement of the amount of a dye, preferably phenolsulphonephthalein, which each kidney excretes.

II. MOVABLE KIDNEY.

The symptomless movable kidney is best let alone, and the patient allowed to remain in ignorance of its wanderings.

When the usual rather vague symptoms are complained of, they are commonly associated with a group of general complaints to which treatment should be primarily directed.

Sudden loss of weight, such as occurs in diabetes or tuberculosis, has been held accountable for the mobility of a kidney in that the usual fat pad about it has disappeared. The weight may be regained by the appropriate treatment of the primary condition but if there are symptoms a belt or corset is necessary.

Repeated pregnancies, faulty posture, or a generally lowered muscle tone may have caused such a relaxation of the abdominal muscles that all the organs in the abdomen are ptosed. For the two latter conditions exercise and a correction of the habitus is best; the muscular relaxation caused by repeated pregnancies requires a belt.

In those cases in which the kidney in an unusual situation suffers by pressure, or causes dragging pains in the back, and for patients whose abdominal musculature has so lost its tone that neither exercise nor a correction of the posture is of assistance, the wearing of a belt or corset may be of assistance. The type of corset known as "straight front" is often entirely satisfactory. Special belts are made to order, either with or without a small pad in front to fit beneath the costal margin of the side upon which the affected kidney lies, and may better suit some patients. Whether corset or belt be worn it is important that it be put on and fastened in position while the patient is supine, and presumably the kidney is in its proper position.

Surgery.—The kidney has been sutured in place, or the capsule has been removed in the hope that adhesions would form to hold the kidney in its normal bed. These operations are not especially satisfactory and should not be undertaken until thorough medical treatment has been tried out.

III. CIRCULATORY DERANGEMENTS.

Chronic Passive Congestion.—The symptoms are usually much overshadowed by those of the causal condition, but the congestion of a moderately damaged kidney caused by cardiac failure, with the resultant lowering in kidney function may confuse the clinical picture of the heart condition considerably.

The treatment is directed at the primary condition, the cardiac failure for instance, and if successful, symptoms of kidney insufficiency will rapidly disappear. In these cases the Karrell diet is often of great value.

Hemorrhagic Infarcts.—The diagnosis can be made only in the exceptional case. With albumin and blood in the urine, no matter what the cause, the patient is put to bed and is usually given a milk diet. If the general condition is good he may go about his usual occupation when the urine has entirely cleared, and with small infarcts, this will usually occur within two or three weeks. It is possible that an abscess may develop, and in that case, unless it discharge into the kidney pelvis, the treatment belongs to the surgeon.

IV. THE NEPHRITIDES.

i. Acute Nephritis.

Acute nephritis may be caused by any one of the acute infectious diseases, by exposure to cold and wet, by the ingestion of certain metallic poisons, or by toxins produced in the body by pregnancy or by extensive lesions of the skin. It is usually held that the renal lesion is the result of the action of toxins of one kind or another rather than actual bacterial infection. When it may be discovered and is still operative the cause of an acute nephritis should be removed.

Treatment.—In but two varieties of acute nephritis is there a causal therapy—those lesions due to syphilis and malaria. In all other cases the aims in treatment are: first, the sparing of a disabled function, and second the treatment of such symptoms as may arise.

Sparing the Renal Function.—**REST.**—The patient should be put to bed and be kept warm. He should wear woollen or Canton flannel night clothing and he may sleep between blankets. The temperature of the room should be between 65 and 70° F. The period of the stay in bed depends considerably upon the urinary findings from day to day. As a rule as long as there are red blood cells in the urine confinement to bed is absolute. In every case it is best to try out thoroughly the effect of a period of three months rest upon albumin and casts unless the urine shall clear up sooner. If at the end of the three months period there are still albumin and casts in the urine it may be best to allow the patient up especially if he appears otherwise to be in good condition. Resumption of activity must be very gradual. The patient should be allowed only to sit up in bed for the first four or five days, then in a chair for the same length of time, and later to walk about the room. The urine should be examined daily for any recurrence of erythrocytes or an increase of albumin, and a return of these symptoms, or of any water retention, should be the signal for further rest. The patient must be also exceptionally careful of contracting any of the minor infections, and of exposure to cold. He should be warmly dressed and it is usually advised that light woollen underclothing be worn.

DIET.—The object of certain limitations of the diet is to spare the kidney in its special function of elimination. The end products of protein are the most difficult for the kidney to handle under normal conditions and the presence of an acute inflammatory process may limit the elimination of

protein considerably. In many cases of acute nephritis the water and salt are also excreted with difficulty and in these patients their ingestion must likewise be strictly limited. It is this latter disability which causes the rather characteristic œdema in these cases.

For the first few days of the disease an exclusive milk diet is usually advisable. Often in the first twenty-four hours, when there may be considerable nausea and vomiting, small amounts of water only are best. When milk is given the amount varies according to the symptoms, but it should rarely exceed 1200 cc. (40 ounces). This will supply about 48 grams of protein and contains about 2 grams of salt. Cream or lactose may be added to increase the caloric value. After a few days, if the symptoms have improved, toast, gruels and fruit juices may be allowed, and after two or three weeks, with continued improvement, the diet may consist of milk, cereals, bread, butter (unsalted), sugar, fruit and one or two eggs each day. Soups and broths made from meat stock are of little food value and the meat extracts which they contain in excess are distinctly irritating to the kidney. Meat is not added until the patient is allowed up and even then the amount should be small and at first not more often than twice weekly.

SALT.—Some of these patients show distinctly an inability to excrete salt and this disability is one of the causes of their œdema. During the earlier stages when there may be considerable swelling of the whole body salt should be kept at a minimum. None is used in the preparation of the food and none is allowed on the patient's tray. Later when œdema has disappeared, a small amount may be allowed at the table. It should not at first exceed 2 grams, should be carefully measured for each day and is best given on the tray so that the patient may add it to the food as he wishes up to the amount allowed. As recovery seems probable more salt may be used but it is best for these patients to always accustom themselves to a low salt intake.

FLUIDS.—The amount of fluid intake depends entirely upon the presence and amount of œdema. When œdema is present fluid should be restricted to 1000 cc. (1 quart), or if there be much œdema the Karrell diet, with its 800 cc. of milk and no other fluid or solid in the twenty-four hours, may be ordered. When the œdema has cleared up and the kidneys are secreting a normal amount of urine the fluid intake may be increased up to 2000 cc. (2 quarts) diluting the substances which must be excreted and rendering them less irritant. When vomiting is a complication fluid should be given by the bowel.

OTHER CHANNELS OF ELIMINATION.—The accessory excretory organs are the skin and the bowels. Both may be made to take some of the load from the kidneys. Attempts have been made to increase the daily amount of saliva, but there appears to be little excretion of toxic products by this channel although large amounts of saliva have been collected in a day.

The bowels should be made to move daily by the administration of a saline cathartic. With marked œdema and signs of uræmic poisoning an active purging should occur, but as the patient recovers and œdema lessens

one or two liquid bowel movements are sufficient. For an active purge Epsom salts in concentrated solution is the best drug. A half ounce may be given every hour until the bowels are freely open. For less active catharsis sodium phosphate or cascara sagrada are useful. Care should be taken that the saline ordered does not contain sodium chloride. The artificial Carlsbad salt of the National Formulary contains about two-thirds of a gram in each teaspoonful, and some of the proprietary salines contain large amounts of salt.

The skin is a useful accessory organ of elimination. The patient should have daily a warm bath so that its usual function may be the best possible. With marked œdema or with uræmic symptoms the patient should be sweated. This may be accomplished by the hot pack, the hot bath, an electric light cabinet or a hot-air bath.

THE HOT PACK.—The patient lies upon a rubber sheet covered by a dry blanket. Another blanket is then wrung dry out of water as hot as can be borne and quickly wrapped about the patient. The dry blanket is then folded over him closely and the free edges of the rubber sheet also folded over. He may be left in the pack for half an hour. Frequently hot bricks or hot water bags are laid about the patient, outside of the dry blanket but inside the rubber sheet, so that the heat may be continued for a longer period of time.

For the hot-air bath a large metal funnel is inverted over a Bunsen burner or alcohol flame on the floor near the bed. From the narrow end of the funnel a stove pipe of about two inches diameter leads beneath the bed clothing which should be supported on a crib, and which should be increased by several thicknesses of blanket.

The hot bath is immersion in water of 100 to 105° F. for 15 to 20 minutes. The patient is then dried rapidly, wrapped in a dry blanket and put to bed. The latter procedure and sweating by means of the electric cabinet are designed for patients who are not extremely ill or uræmic; the hot pack and the hot-air bath for bed patients. During any of these procedures a coldcloth or an ice-bag should be applied to the head, and usually it is best to allow the patient a glass or sometimes two glasses of water during the sweat. With a few patients difficulty may be experienced in getting the skin to act freely during the application of heat. To them a hypodermic injection of pilocarpine nitrate may be administered a few minutes before the pack is begun. The dosage usually advised is six milligrams ($\frac{1}{10}$ grain). Sweats are usually given but once in each twenty-four hours.

DIURESIS.—The kidney is acutely inflamed and unable to properly perform its function. As all therapeutic effort is directed at giving the kidney a rest the administration of diuretics is unwise. They are stimulants to the kidney cells and the result of this stimulation, while it may increase the urine at first, may be worse in the end. But one exception may be made to this rule, the use of digitalis when there is cardiac deficiency, the increased circulation through the kidney causing an increased excretion of

urine. As the patient recovers and the urine output mounts diuretics are not as a rule necessary, the best measure to increase the output being an increase of the water intake.

Symptomatic Treatment.—*Vomiting* at the onset is best relieved by withholding all food for twenty-four hours, allowing only small amounts of water at frequent intervals.

Pain.—For the backache of acute nephritis a warm moist application is most efficacious and is best applied as a large thick flaxseed poultice to the lumbar region. Heat may also be applied as a hot water bag or an electric pad. Mustard plasters are best avoided as a small part of the material is absorbed and is an irritant to the kidneys. Heat will not only relieve pain but often appears to start or increase the flow of urine. The high hot colon irrigation, using gallons of plain water in a continuous flow is especially favored by obstetricians in the treatment of complicating renal disease in pregnancy.

Anæmia is often severe and becomes more noticeable as the patient convalesces. After the acute symptoms of the kidney disease have subsided iron may be ordered and should be given in small doses. The most favored preparation is Basham's mixture (mistura ferri et ammonii acetatis), but the tincture of the perchloride or ferrous carbonate (Blaud's pills) may be used.

Bichloride of Mercury Poisoning.—The accidental or suicidal ingestion of bichloride of mercury has become of such frequent occurrence that everyone should be prepared to immediately institute measures which have been found effective in the care of such patients. While renal damage is not the only ill effect of bichloride of mercury poisoning, the kidney inflammation so produced is the usual cause of death and for this reason the subject has been considered under acute nephritis. Treated early, most of these patients may be saved; results of delayed treatment vary with the amount of damage done but no case appears to be too desperate. The procedure described by Lambert and Patterson is in most common use. It has been modified in various ways from time to time but in the essential points there is no change from that which they advocated.

Lambert Patterson Treatment.—When the patient is seen within a few hours of ingestion of the poison the whites of several eggs are administered and the stomach is thoroughly washed out with plain warm water. The returned fluid from the first washing or some of the vomitus should be saved to confirm the history of ingestion of bichloride. If after an hour the patient still vomits gastric lavage is repeated.

Immediately after lavage is completed a solution of potassium acetate, 4.0 grams (1 dram) to 500 cc. (1 pint) of water is started by continuous rectal drip and should be continued day and night until recovery is assured.

When vomiting has stopped the patient is given every two hours by mouth 250 cc. (1 glass) of the following mixture—potassium bitartrate 4.0 grams (1 dram), sugar 4.0 grams (1 dram), lactose 30.0 grams (1 ounce), lemon juice 30.0 cc. (1 ounce) and boiled water enough to make 500 cc. (16 ounces). On the alternate hours the patient is given a glass of milk.

The stomach is washed out twice daily with plain water and this must be continued until the patient is out of danger. The lavage of the stomach day after day is an important part of the treatment. Mercury is absorbed from the intestinal tract and part of it is excreted into the stomach from where it descends to the intestine to be reabsorbed. Not an inconsiderable part of the mercury is removed by the daily lavage.

Morning and evening the colon also is thoroughly irrigated with plain hot water or saline solution. Once daily a hot pack is given.

When a single dose of the poison has been ingested the treatment may be discontinued after two negative urine examinations on successive days. One to three weeks are usually necessary, depending upon the size of the dose, whether it was repeated, delay in instituting treatment, and the previous condition of the kidneys.

ii. Chronic Nephritis.

Probably the first symptoms of any variety of chronic renal disease are urinary—the excretion of albumin with or without casts. These findings may be made during any routine examination; the individual protests that he feels perfectly well, and the physician may be unable to find any other abnormality. It is in the proper classification and care of these individuals that chronic nephritis may be prevented or postponed.

Janeway says that persons who present only the finding of albumin in the urine with or without casts may be divided into three groups as follows:

1. The postural albuminuria of certain young people. It disappears upon rest in bed only to reappear when the patient rises. In many instances it may be increased by assuming for a short time an unnatural lordotic position.

2. Cases which are probably the recovery from mild attacks of acute nephritis which have been otherwise symptomless.

3. The largest group caused by a number of factors, but in which may be found the beginning cases of chronic nephritis.

In this latter group a careful search of the body should be made for any general or local cause of kidney irritation. Syphilis, malaria, and tuberculosis should be excluded. The first two receive their specific remedies, the latter should have the usual care of any case of tuberculosis. Irritation of the kidney associated with the chronic metabolic disorders of gout and diabetes improves when the primary disorder is properly cared for. A failing heart is a common cause of urinary albumin and casts, and these promptly clear up when the circulation is again normal. Chronic foci of pus should be eradicated in any event. Local causes of albumin in the urine may be an unsuspected calculus, a tumor of the kidney, or a chronic pyelitis. Chronic cystitis or the constant presence of residual urine from an enlarged prostate may cause kidney irritation. Finally there are cases in which no cause may be found and such may be considered as cases of early chronic nephritis. Proper advice may postpone their stage of kidney disability for years.

Treatment.—Patients with probable early chronic nephritis should be taught how to avoid kidney irritation and how best to spare the renal functions unnecessary work.

Exposure.—Cold and wet should be avoided as much as possible. The feet especially should be kept dry at all times. It is best to wear light woollen or wool mixed underclothing. The acute minor infections of the respiratory tract should be avoided, and, if contracted, carefully cared for. For patients who can afford it a sojourn in the South during the winter months is advisable, or the patient may permanently reside in such equable climates as that of southern California.

Occupation.—Heavy physical labor, especially when it may be shown to increase the albumin, and occupations in which the mental and emotional strain is excessive should be avoided. When it is not possible to change the occupation, the usual thing when an individual feels as well as these patients do, an effort may be made to break the day by a rest after lunch, and to have the patient take frequent week-end vacations, and whenever possible, get at least one month's vacation in summer.

Exercise.—All these patients should take some form of daily exercise. Its amount and character depend upon the age of the individual. Its effect upon his albumin excretion should be observed. As a rule exercise should be less in amount and duration than that indulged in by normal individuals of the same age and sex.

DIET.—There need be no change made in the diet if it be of normal proportions, of a simple character, and if the caloric intake is not excessive for the individual. Richly prepared foods and those highly seasoned should be avoided. The condiments, especially mustard and pepper, are kidney irritants. Their use is a habit and the frankly nephritic patient must do without them. It is best too to have these individuals accustom themselves to a low salt intake, using only that which is ordinarily added to food in its preparation. It is not necessary to prohibit meat. Beef, lamb, fowl and fish may be eaten, an ordinary serving once daily. The occasional use of one of the gland meats probably does no harm but their frequent use or the daily use of bouillon or meat stock soups may be prohibited. The protein intake should not exceed 100 grams per day.

The water intake should be five to seven glasses a day. Alcohol is injurious to the kidneys and the immoderate use of tobacco should be warned against.

Overweight should be prevented or reduced by the necessary restriction in the total diet.

THE BOWELS.—When there is not a natural daily bowel movement the fault should if possible be corrected by dietary adjustment. Raw or stewed fruits, any green vegetable except onions, garlic, and celery which are kidney irritants, and cereals may be eaten without harm. The addition of agar-agar or of bran to the diet may assist. Mineral oil may be tried. The attempt

to train the rectum to the habit of emptying itself at a fixed hour each day should always be tried. Obstinate cases should receive a mild but sufficient daily laxative.

More severe grades of chronic nephritis may usually be classified by their symptoms and the functional disability present into one or the other of the two main clinical types. By far the greater number show the insidious progress, the polyuria with traces of albumin and a few casts, and finally the cardiac or uræmic symptoms with nitrogen retention of the type known as chronic interstitial nephritis. A relative few show the œdema, oliguria with large amounts of albumin, and the fluid retention whether due primarily to salt retention or not, of the chronic parenchymatous type. Not all cases may be so readily grouped, and there are various grades of either type. Advice as to exposure, occupation and exercise does not differ materially from that given the potential nephritic except that it may be emphasized that transgressions are more certainly followed by evil consequences. With respect to the diet and the fluid intake however the treatment varies quite radically in each type, but in every case it should be based upon the functional disability present. All chronic nephritides do better when in warm climates; all are better when they may avoid prolonged mental or physical stress; and most of them, during the earlier stages at least, are better when they take an amount of daily exercise which will not exhaust them.

(a) CHRONIC PARENCHYMATOUS NEPHRITIS.

Treatment.—**Rest.**—Patients with marked grades of nephritis of the salt and water retention type often seem like cases of acute nephritis and œdema will usually clear up more rapidly when they are put to bed at the beginning of treatment. Rest should not be continued for any longer than is necessary to clear up the œdema as the general well-being and the condition of the digestive tract seem better when moderate activity is permissible.

Diet.—In patients with chronic parenchymatous nephritis the excretion of water and of salt is especially interfered with. It is unusual for this type of nephritis to have marked retention of nitrogen; indeed, Epstein claims that the main factor in lowering the water excretion is the impoverishment of blood plasma protein by the large albumin output, and upon this basis feeds these patients an excessive amount of protein. His views have not been generally accepted.

It is however generally agreed that the power to eliminate water and salt is interfered with and that the regulation of these two factors in the diet is of most importance. Protein is often cut down in the early stages especially as it has been found to act as a kidney irritant.

KARRELL.—On beginning treatment when there is much œdema the Karrell diet is excellent. In each twenty-four hours 800 cc. (28 ounces) of milk, and no other fluid or solid, is given in four doses. Such a diet provides a limitation of the fluid intake, reduction of sodium chloride intake to about 1.2 grams, a protein allowance of about 30 grams, and total calories

of 700. This amount of milk, according to the Karrell diet is continued for five to seven days. On the eighth day, one soft cooked egg and two pieces of dry toast are allowed; on the ninth day, two soft cooked eggs and four pieces of dry toast; and on the tenth day vegetables may be added. The butter and toast should be salt free and no salt should be added to the eggs or vegetables. On such a diet the œdema usually clears up rapidly, but there are cases in which it appears necessary to continue to diet for four or five days before diuresis begins.

SALT POOR DIET.—When symptoms are not so urgent, or there are no signs of marked renal irritation such as red blood cells in the urine a salt poor diet may be ordered. Foods listed in the following table may be used in constructing such diets.

TABLE OF CHLORINE-POOR FOOD.

	Percentage of Chlorine.
Sugar.....	0.00
Fruit raw or dried, under.....	0.01
Butter, unsalted.....	0.02
Potatoes, white.....	0.03
Oatmeal.....	0.035
Rice.....	0.05
Cornmeal.....	0.06
Green vegetables, except celery, under.....	0.06
Wheat flour.....	0.07
Egg, one whole.....	0.10
Milk whole.....	0.12

In the preparation of bread or cooking the other articles of food no salt is to be used.

Bakers' bread contains about 0.7 per cent, sodium chloride. Beef contains about 0.05 per cent. sodium chloride. Cheese averages over 1 per cent. of common salt. Fish are of high salt content 0.2 to 0.6 per cent.

When œdema has disappeared the function for water elimination should be tested and fluid ingested as fast as it can be excreted. The usual amount given is 1500 to 2000 cc., but this is regulated by the œdema and may of necessity be lessened by circulatory deficiency. The function for sodium chloride may be tested later and an amount slightly below the tolerated amount is then allowed.

Bowels.—During the cedematous stage two or three watery movements daily assist materially in water elimination. To produce them a saline is best and magnesium sulphate in concentrated solution to be taken first thing in the morning is usually advised. As the œdema lessens the same laxative may be continued but the dose should be so reduced that there are but one or, at the most, two loose evacuations. The patient should not be depressed. At this time a vegetable laxative may be taken with better effect. If a proprietary be prescribed or one of the spring waters, the physician should assure himself that it contains no sodium chloride.

The Skin.—Elimination of water through the skin may be brought about by the use of one of the sweating processes. When the patient is in bed the hot pack is best, but after he is allowed up, the hot bath, the electric light

cabinet or the Turkish bath may be used. The sweat may be repeated daily. It may be continued after œdema has disappeared but is then given less frequently, not oftener than twice weekly.

Diuretics.—The best diuretic is water given in amounts of 1500 to 2000 cc. as soon as the kidney has demonstrated its ability to excrete that amount. Diuretic drugs are inadvisable. The kidney may respond for a few days but after that the water excretion has been found worse than before. Occasionally digitalis may so improve the circulation that an increased water excretion results but its use is limited to patients with cardiac failure.

Symptomatic Treatment.—**ASCITES AND PLEURAL EFFUSION.**—The pleural and abdominal cavities may require drainage. Aspiration of the fluid is performed as is done for any other collection of fluid in these cavities.

Drainage of the legs by incision or by means of Southey's tubes has been used in some cases of obstinate œdema. Asepsis must be faultless as there is always danger of infection and cellulitis.

Anæmia is best treated by the administration of iron. Basham's mixture (liquor ferri et ammonii acetatis) is the best preparation. The tincture of ferric chloride and pills of ferrous carbonate have been used.

The uræmia which may develop in these patients is considered in the section upon the treatment of this complication (page 418).

(b) CHRONIC INTERSTITIAL NEPHRITIS.

In the earlier stages the symptoms complained of are usually those due to arterial hypertension, and the necessity of rising at night to void. Later, the long continued hypertension causes left ventricular hypertrophy, and, as this progresses, a stage of heart failure symptoms may develop. Finally the end comes by a vascular accident, cardiac failure, or by uræmia. In early or moderately advanced cases much may be done to prolong life and to make the patient more comfortable. Later, when kidney function has fallen below the ability to excrete the end products of the protein necessary for metabolism, the problem is almost hopeless.

Treatment.—The aims in treatment should be to guard the kidney from further damage, to lighten the burden under which it works, to increase elimination by other channels, and to relieve the symptoms.

Prevention of Damage.—This in general means the institution of a correctly hygienic life and is especially applicable to the early and moderately advanced case. All factors which may abuse the kidney function must be avoided, whether they be gross errors in diet, alcoholic excesses, mental or physical overwork or worry, or one or another of the acute infectious diseases. It may also be said to apply to the moderately damaged kidney whose function is lessened by chronic passive congestion from circulatory failure.

Chronic local inflammation of the bladder or pelvis of the kidney, or an hypertrophied prostate may seriously affect the renal function. Focal infection of any part should be eradicated whenever possible.

Sparing Renal Function.—For the purpose of sparing the kidney in its work, the most important measure requiring regulation is the institution of a proper dietary régime. The fluid intake and work and exercise must also be reviewed.

DIET.—The regulation of the amount and character of the food intake is the most essential element in the treatment of the chronic nephritic, and with the functional tests now in use this may be done upon direct evidence of the excretory ability of the kidney. These tests are not yet entirely satisfactory, especially for the earlier cases, but they have shown us in the late cases in what manner the kidneys are disordered and this may be taken as evidence in what respects the kidney should be especially spared.

The kidney of advanced chronic interstitial nephritis is unable to excrete the amount of nitrogen resulting from the metabolism of the protein of ordinary diets, and its retention may be demonstrated in the blood in the late cases. In earlier cases no nitrogen retention is demonstrable unless the patient is on an inordinately high protein intake. In the earlier cases it is usually advised that the diet contain 70 to 80 grams of protein daily, because this is sufficient for body requirements and an excess only throws unnecessary work upon the kidneys. Squier and Newburgh have shown that a high protein diet in patients with renal damage produced an increase of albumin and red blood cells in the urine, though no change was noted in the blood pressure. An allowance of 70 grams of protein daily permits one or two eggs, and a small piece of meat—beef, lamb, chicken, or fish—each day. The remaining protein is made up from that in the bread and cereals. Meat soups and the gland meats, such as sweetbreads and liver, are usually forbidden as they contain purins and extracts which are difficult of excretion. The carbohydrate and fat in the diet is limited only by the amount required to supply the necessary calories for the individual at varying occupations, and, unless he is overweight, he may, with the protein limitation to 70 grams, choose his own diet. The condiments are best omitted altogether as it is held that they are kidney irritants. Salt should be kept at a low intake—no more being allowed than that necessary for the preparation of the food. A daily intake of 3 or 4 grams is sufficient for the bodily requirements and this amount, including that which is in various foods, is sufficient to make the food palatable.

Water is usually required in more than normal amounts, but the quantity must be gauged to the circulatory capacity in many cases. It has been found that a much increased water intake will raise the blood pressure, and for the patients who have a much enlarged heart with signs of minor failure the water intake must be reduced. Eight to ten glasses of fluid each day should be sufficient. When patients are sweated more water may be allowed during the bath.

In more advanced cases the protein intake is limited by the degree of nitrogen retention. In some cases the reduction of protein to 50 grams daily may be sufficient to keep the blood urea within normal limits, but as a rule the protein restriction must, for a time at least, be lower than this.

Then if blood urea falls to normal, protein may be slowly added, but to not more than 50 grams daily. The low protein diets include fruits, cream, cereals, cornstarch, white and sweet potatoes, rice, green vegetables, and as much sugar and butter as are necessary to make cream soups or puddings of these articles. In the most severe cases feeding is much limited by anorexia or by nausea and vomiting. Any food taken should be of low nitrogen content. Chace used milk sugar lemonade for the severe cases, but found that this could be taken for only a few days before the body protein was used. There is but slight chance that the function for nitrogen elimination will improve, but these low protein diets may be tried and an occasional case will improve.

Water.—The fluid ingestion should be above normal unless there is œdema. Too small an amount of water concentrates the retained toxic products though a great excess of fluid probably helps very little in washing them out of the body. About 2500 cc. (80 ounces) is an appropriate daily amount.

WORK AND EXERCISE.—In the early cases care must be taken that work which raises blood pressure unduly is avoided. Long continued mental or emotional strain is the greatest factor. It is not wise to have a man give up his business, but he should learn to give it shorter hours, take a rest at midday, and at each week end, and a long rest during the summer. Often too there is much benefit from a vacation during the winter months and this may advantageously be spent in the South. There is less likelihood of contracting colds and the skin is kept more active in warmer climates.

Elimination.—Elimination is assisted by increasing the action of the bowels and skin.

THE BOWELS.—A daily saline laxative should be given in dose sufficient to produce one or two soft or watery stools. In the more severe cases active purgation may be tried, but cannot be continued without depressing the patient.

THE SKIN.—In early ambulant cases the electric light cabinet and the Turkish bath are best. Late cases, in bed, must be sweated by the hot bath or pack. When uræmia threatens, a sharp purge and a sweat will frequently postpone it.

DIURETICS are usually condemned. The kidney is excreting as much water as it can in the effort to get rid of the accumulated metabolic products, and there is no evidence that any drug makes these products easier to eliminate or that diuresis carries off anything but extra water. Foster says that diuresis concentrates the retained toxins making uræmia more likely. The best method of increasing the water elimination is by an increase in the fluid intake. This may not however be pushed too far, as an increase in water ingestion may increase the blood pressure.

Symptomatic Treatment.—*HYPERTENSION.*—An increase in blood pressure seen in patients with chronic nephritis is regarded as a compensatory reaction and as necessary for the best utilization of all function possible

in the damaged kidney. For this reason the reduction of hypertension by the administration of vasodilating drugs, such as nitroglycerine and sodium nitrite is contraindicated except in unusual incidents. The blood pressure may be increased over that necessary for the best function of the kidneys by other factors such as mental stress and emotion and by physical excess. In cases with inordinately high blood pressures a few days rest in bed on a diet of milk and cereals is the best treatment. Bromides or small doses of chloral may advantageously be given for the first few days and either drug may be continued after the patient is up and about. Often small doses of bromides and chloral will relieve distressing headache and vertigo. When the occupation is resumed, the patient should reduce the amount of work and worry by spending shorter hours at the office, resting at midday, and taking some mild outdoor exercise once or twice each week. Most patients are better with a moderate amount of daily exercise. Quiet walking, never carried to the point of fatigue, is best. It appears to improve the general health and feeling of well-being, assists the digestive tract and the skin and even a myocardium which seems to be on the verge of failure may be improved. The greatest contraindication to exercise is precordial pain, and when this is present great care must be taken with any physical exertion as a severe anginal attack may be thereby precipitated.

Headache and dizziness are usually due to excessive blood pressure or to marked fluctuations in blood pressure. Some of these patients experience relief upon administration of a dose of nitroglycerine, a tablet dissolved upon the tongue. At times a severe spontaneous nose bleed will relieve symptoms and would seem to indicate venesection in some of these patients. It cannot well be repeated at short intervals, as anæmia is usually already a complicating factor, but it may be of value in the plethoric patient at beginning treatment. A milk day, with rest in bed one day each week, materially helps some patients. The vasodilating drugs used simply to reduce hypertension are useless and may be harmful, but they are of occasional value for the treatment of such symptoms as sudden headache and vertigo.

HEART FAILURE.—When hypertension has continued for long periods, signs of cardiac hypertrophy and dilatation may be expected and it should not be forgotten that chronic passive congestion added to a kidney deficiency may so lower the factor of safety that elimination is insufficient. When heart failure is present the treatment is primarily that of the circulatory condition. The patient should be put to bed at absolute rest, and digitalis, as for any other circulatory decompensation, should be administered. If œdema be marked, fluids and salt should be restricted, the Karrell diet often being the best. For these patients with circulatory failure, diuretics may be used to eliminate water and are sometimes invaluable. Theobromine sodium salicylate is best and may be administered in doses of 1 gram (15 grains) three or four times daily. As dyspnœa and œdema disappear, the chief factor in producing the heart failure—hypertension—is then the object of treatment. Carefully graded exercise may so improve the myocardium that it is better able to withstand further demands for work.

Gastric distress caused by flatulence or hyperacidity may be relieved by a few doses of bicarbonate of soda. Occasionally a bitter tonic is necessary. If vomiting occurs, a day or two of starvation, allowing only water, may be effective in its control. When vomiting is persistent a general sedative such as a small dose of morphine sulphate is usually more effective than local sedatives for the stomach.

Diarrhœa is often an eliminative effort. It is best not checked unless exhausting to the patient.

Anæmia may be improved by the use of small doses of iron. Basham's mixture (liquor ferri et ammonii acetatis) is often used.

V. URÆMIA.

Uræmia may develop in any form of acute or chronic nephritis, or from conditions which have caused anuria. The various forms have been fully described in the volume on Diagnosis.

Treatment.—The outlook in patients who have developed uræmia in the course of an acute or parenchymatous nephritis is not so serious, but that which begins insidiously in chronic interstitial nephritis is usually fatal.

VENESECTION.—The acute convulsive types are usually encountered in robust looking plethoric men and for these individuals bleeding, with the abstraction of from 600 to 700 cc. (20 to 24 ounces) of blood, is indicated and appears to directly influence recovery. For the patient with insidious onset which gradually deepens to coma, bleeding is of little avail.

Lumbar puncture will often relieve the convulsive type and is sometimes of value in the types with slow onset. Fluid should be allowed to run until it comes in slow drops and the operation may be repeated as necessary if improvement occur.

DIET.—The food intake is usually limited by coma or by nausea and vomiting. It should in any case contain a minimum of protein. Fruit juices with milk sugar have been used, but they cannot be continued for more than a few days at a time.

Sweating by means of the hot pack or the hot bath is of value and should be tried in all cases. The excretion of sweat may be promoted by the use of pilocarpine hypodermatically, and at times this remedy may be used in small doses three or four times daily to promote more or less continued sweating.

Janeway makes a point of assuring oneself that there is no chronic passive congestion of the kidneys from cardiac failure, and speaks of the marked improvement seen in these patients upon the administration of digitalis.

Active purging is of distinct service. In the more chronic cases Epsom salts may be used or compound jalap powder. With the acute uræmic cases a more active hydragogue cathartic may be used and elaterin may then be given in doses of 0.003 gram ($\frac{1}{20}$ grain).

For the restlessness delirium and convulsions, sedatives are of value. Bromides and chloral may be administered by mouth or by rectum, and morphine, the most serviceable sedative, is injected hypodermatically. When there are severe convulsions, chloroform inhalations may be used.

VI. TUBERCULOSIS OF THE KIDNEY.

Treatment.—When it has been determined that the process affects but one kidney the treatment belongs to the surgeon. Nephrectomy should be done without delay. Afterward associated bladder lesions should be treated and are often very obstinate. If tuberculosis be present in both kidneys surgery is not indicated, unless it appears that one kidney is the seat of a large abscess. This may be opened and drained.

Patients with miliary tuberculosis, and those with local tuberculosis of one or both kidneys should observe the general hygiene, and receive the treatment in general use in tuberculosis of other organs.

VII. SYPHILIS OF THE KIDNEY.

The diagnosis of syphilis of the kidney can rarely be made. When it seems probable, the general treatment and diet should be similar to that of acute nephritis. The specific medication should be arsphenamin, given in small doses and as the patient improves mercury may be cautiously started.

VIII. PYELITIS.

The form of pyelitis usually encountered is mild and while often exceedingly stubborn, is amenable to medicinal therapy. Pyonephrosis, or renal abscess, belongs to the surgeon. The kidney may be removed entire, or it may be opened and drained depending upon the condition of the patient and upon that of the kidney. Pyelonephritis is often best relieved by a combination of medical and surgical procedures.

Treatment.—In every case the probable cause must first be taken into consideration. Constipation is often associated and the infection of the kidney pelvis is frequently relieved by its correction. Any obstruction to the urinary outflow such as an enlarged prostate, chronic cystitis, urethral or ureteral stricture, should be removed or corrected as nearly as possible. Sometimes pus foci in various parts of the body appear to be responsible for pyelitis. They should always be examined for and removed.

Fluids.—The fluid intake should be increased to two or three quarts daily. In acute conditions with fever the fluid may be largely milk with very little other solid food. In ambulatory cases plain water is best. If it appear desirable to render the urine alkaline, one of the mildly alkaline waters, such as Celestin Vichy may be prescribed or a part of the fluid may be lemonade.

Drugs.—Hexamethylenamin in doses of 0.3 to 1.0 gram (5 to 15 grains) is the most satisfactory drug for a urinary antiseptic. Its activity depends upon the freeing of formaldehyde which occurs only in an acid medium. It is therefore important that the urine be acid when the drug is administered, and that no acid or acid salts be given at the same time. If the urine is acid, hexamethylenamin may be administered without any other drug; but if the urine be alkaline, acid sodium phosphate is administered two hours before each dose of hexamethylenamin.

In early or acute cases of pyelitis it may be found that strongly acidifying the urine may cause frequency and strangury. It is then best to alkalinize the urine by the administration of alkaline drinking water, or potassium citrate, or sodium bicarbonate for several days, and during this time suspend the administration of hexamethylenamin. The alkalinization itself will often check the inflammation as the bacteria, which are usually operative in the early cases, do not thrive well in an alkaline medium. After several days hexamethylenamin may be resumed, usually best given in smaller doses and at first with smaller doses of acid sodium phosphate. The urine should be watched daily as the drug will at times cause an inflammatory reaction in the genito-urinary tract and even at times hemorrhage. Infections produced by the ordinary pyogenic organisms yield rapidly, but colon bacillus infection is exceptionally resistant. In every case medication should be continued for two or three weeks after the urine has entirely cleared of pus and organisms.

Vaccines have been tried, but they are not satisfactory whether they be stock or autogenous preparations.

In the acute cases, as the fever declines, the diet should be increased, the food being limited to nourishing bland preparations, and excluding all articles which are irritating to the kidney, such as mustard, pepper, etc.

The persistent infections sometimes improve after irrigation of the kidney pelvis through the ureteral catheter. Such work should be done only by an expert in cystoscopy.

Patients in whom there is inflammation of the kidney itself with pyelitis, or pyelonephritis, have considerably more severe general symptoms. They may develop an abscess in the kidney which then will require surgical interference.

IX. OTHER KIDNEY AFFECTIONS.

The treatment of abscess in or about the kidney, of calculus, and of cysts or tumors of the kidney is in the province of the surgeon and will not be considered in this book.

XIV.

THE TREATMENT OF DISEASES OF THE BLOOD AND THE
BLOOD-MAKING ORGANS.

SAMUEL BRADBURY.

I. ANÆMIA.

i. The Secondary Anæmias.

SECONDARY anæmia is one of the most frequent conditions which the practitioner is called upon to treat. It is a complication of many of the infectious diseases, especially those in which there is long continued fever, of intoxications which follow the chronic visceral diseases, and of chronic poisoning by various metals or chemicals used in industrial work. It may be produced by acute large hemorrhages or long continued and repeated small blood losses which occur with ulcers of the intestinal tract or with hemorrhoids.

Treatment.—There will be no doubt as to the cause of anæmia following a large acute hemorrhage. If stopped before the patient is in extremis the healthy adult will usually recover quite rapidly, but the lives of many persons have been saved by a prompt transfusion.

In other cases of secondary anæmia the cause must if possible be determined. The cases due to repeated small blood losses will be found to respond most quickly to treatment. Some of these cases may require medical treatment, preferably transfusion, before a necessary surgical procedure to control the bleeding may be undertaken. The anæmias due to chronic visceral disease, such as nephritis, are as a rule difficult to treat, while those in which the primary cause is removable such as focal infection or chronic metallic poisoning recover upon removal of the causative factor.

General Management.—The living conditions and other hygienic causes should be carefully reviewed and corrected when necessary.

DIET.—The diet, except where special indications must be met, as for chronic nephritis, should be nourishing and easily digestible but otherwise contain all articles of foods. It has been estimated that the average requirement of iron is 10 to 12 milligrams per day, and probably women and children need a little more than this to replace blood lost during menstruation and to supply requirements of growth. Ordinary diets usually contain easily this amount but the intake may be increased, when digestive conditions permit, by the use of the green vegetables and meat.

IRON IN FOOD.

Selected from Carter, Mason & Howe.

Dandelion Greens.....	0.027
Lentils.....	0.0086
Egg yolk.....	0.0085
Beans, dried.....	0.007
Beans, lima, dried.....	0.007
Wheat.....	0.0053
Peas, dried.....	0.005
Fish.....	0.004
Oatmeal.....	0.0036
Meat.....	0.003
Egg, whole.....	0.003
Spinach.....	0.003
Dates.....	0.003
Olives.....	0.0029
Bread, whole wheat.....	0.0015
Cocoa.....	0.0005
Milk.....	0.00024
Cream.....	0.0001

Amounts are in grams per 100 grams of food substance.

In children constipation is often the cause of mild grades of anæmia and will usually yield readily to a bulky diet and insistence upon the establishment of proper daily habits.

OPEN AIR.—Spending the waking hours in the sun and open air is always beneficial. When anæmia is severe the patient may rest in the open, but with mild anæmia moderate exercise is better.

Certain obscure anæmias are improved by a change to an altitude of 3000 to 5000 feet, as this is always a stimulus to the blood making organs.

Drugs.—The administration of iron or of arsenic is often beneficial in moderate or severe grades of secondary anæmia.

IRON.—The manner in which iron acts is unknown. Von Noorden says that “under the stimulus of iron the blood forming organs become active in the synthesis of hæmoglobin.” It has been found that animals will utilize iron more readily after hemorrhage and the use of iron in cases of secondary anæmia seems to hasten the recovery of the normal hæmoglobin percentage.

When iron in any preparation is administered by mouth very little is absorbed, most of it passing through the intestinal tract unchanged. Part of it may be changed to the sulphide and blacken the stools.

The most extensively used preparations are reduced iron (*ferrum reductum*) in doses of 0.06 gram (1 grain); *ferri carbonas saccharatus* in the form of pills, 0.1 to 0.3 gram (2 to 5 grains); and, especially for children, syrup of ferrous iodide 0.3 to 1.0 cc. (5 to 15 minims) in water. Tincture of the chloride of iron in 0.3 cc. (5 minim) doses, and Basham’s mixture (*liquor ferri et ammonii acetatis*) 8 cc. (2 drams) are also of value. All oral iron medication should be administered after meals, and the liquid preparations, except Basham’s mixture, should be taken through a glass tube to avoid corrosion of the teeth.

For hypodermic administration, the citrate of iron in 5 to 10 per cent. solution is best. The dose is 0.06 gram (1 grain). It is readily absorbed and may be used when there is gastric disturbance.

ARSENIC.—Arsenic is of value in anæmic conditions. In experimental work, when administered over long periods to growing animals, the bone marrow becomes more vascular. The erythroblastic elements do not change but there is an increase in the leucocytic tissues. When too much arsenic is given, the bone marrow, in rabbits, undergoes hyaline degeneration and there is a decrease in erythrocytes and hæmoglobin.

The preparations used in anæmia are arsenic trioxid (arsenous acid) in doses of 0.0005 to 0.002 gram ($\frac{1}{120}$ to $\frac{1}{30}$ grain), and Fowler's solution (liquor potassii arsenitis) in doses of 0.2 cc. (3 minims). Both preparations are given after meals. Fowler's solution is usually begun at the dose indicated and this amount is increased daily to 0.6 or 1.0 cc. or until symptoms of minor intoxication ensue, such as slight nausea, a metallic taste in the mouth, colicky pains in the abdomen, or puffiness under the eyes. The urine may show albumin. Upon the appearance of such symptoms the drug must be discontinued.

Long continued therapeutic doses of arsenic may produce pigmentation of the skin.

For hypodermic use sodium cacodylate (sodium dimethylarsenate) may be injected subcutaneously or intramuscularly in doses of 0.06 gram (1 grain) from three times weekly to daily. It is best purchased in the solution in ampoule dosage. The organic preparations, arsphenamin and neoarsphenamin, have been described in the section on syphilis. They are not indicated in anæmic conditions.

Transfusion.—It is in the secondary anæmias resulting from single large hemorrhages, and the intense anæmias of the long continued daily loss of small amounts of blood, that transfusion of whole blood finds its most useful field. It has been used with temporary benefit in primary anæmia, in diseases in which there is uncontrollable bleeding, and at times in chronic blood infections.

The transfusion of whole blood has been attempted for several centuries, but it has been only in the past decade or two, when methods have been such that the amount transfused could be measured accurately, and an exceptionally skilled technic could be dispensed with, that transfusion has been widely practised. Earlier methods were by artery to vein anastomosis, and a syringe method was tried in animals long before the days of asepsis. Recently paraffin coated collecting vessels known as Kimpton-Brown tubes have been used; the syringe method was perfected by Lindeman, and improved by many modifications; and the citrate method has been developed. The latter, because it could easily be performed by one man and haste was not necessary, was officially recommended as the method for use in the American Expeditionary Forces. There seems to be no doubt that it is more readily available to the majority of practitioners than any of the other methods.

The more frequent use of transfusion as a therapeutic procedure has stimulated study of the causes of reactions and of the occasional fatalities which may follow. For the reactions which immediately follow the operation it has been found that the agglutinins or hæmolyins are mainly responsible, but the cause of late reactions is still quite obscure.

Practically all bloods fall into one of four major groups as regards the agglutination reaction. These groups are established by the presence of two chief agglutinins in the sera and of receptors in the blood cells. Each of two groups of sera have one agglutinin, a third has a mixture of both agglutinins, and the fourth has no agglutinin. Jansky in 1907 was the first to correctly describe these four groups and his classification follows:

- | | |
|---|--|
| 1. Serum agglutinates cells of 2, 3, | 4. Cells not agglutinated by any serum. |
| 2. Serum agglutinates cells of 3 and 4. | Cells are agglutinated by serum 1 and 3. |
| 3. Serum agglutinates cells of 2 and 4. | Cells are agglutinated by serum 1 and 2. |
| 4. Serum agglutinates no cells. | Cells are agglutinated by serum 1, 2, 3. |

OR TABULATED

Cells	Serum				
	1	2	3	4	
1	O	O	O	O	
2	A	O	A	O	
3	A	A	O	O	"A" = agglutinates.
4	A	A	A	O	

It has also been found that the agglutinins usually appear about the third year of life, but that 13 per cent. (Unger) of the newborn have them, and that blood of the mother and of her infant may be incompatible. Karsner estimates that the chances of success, if transfusion be done without testing, are 64.9 per cent.; or, to put it another way, nearly four patients in ten will have a severe, possibly fatal, reaction if the blood is not tested. It is therefore essential that in every case the group of the blood of donor and recipient be known before transfusion is done, and Unger says that both bloods should be tested against each other whether the group of the donor be known or not. The most important reaction to avoid is that the serum of the patient shall not agglutinate the cells of the donor.

In selecting a donor two tests must be done—the Wassermann reaction, and the test for agglutinating reaction. Moss found in extensive observations that hæmolysis was always accompanied by agglutination but that agglutination frequently occurs without hæmolysis, so the test for hæmolysis may be dispensed with. The test for grouping is easily carried out and the one most frequently used is that suggested by Minot. Three or four drops of a solution of 1.5 per cent. sodium citrate in 0.9 per cent. sodium chloride solution are placed in each of two small test tubes (1 cm. by 2 to 5 cm.). Then in one tube are placed nine drops of blood from the recipient and one drop from the donor, and in the other tube are placed one drop from the recipient and nine drops from the donor. The blood drops are collected from a prick in the ear or finger, and, if possible, they should be allowed to fall directly into the citrate solution. After mixing they are allowed to stand for fifteen minutes. Then a drop is removed from each

tube, placed on a glass slide, diluted with a drop of normal saline solution, a cover glass applied, and the mixture is examined under the microscope for clumping. If there is no agglutination in either mixture, transfusion is safe. If clumping is present in the mixture of nine drops of the recipient's blood and one drop of the donor's blood, it means that the recipient's blood agglutinates the donor's blood and transfusion is dangerous. If clumping is present in the mixture of nine drops of donor's blood and one of recipient's blood, the donor's plasma agglutinates the recipient's cells and transfusion is allowable if no better donor can be had.

TECHNIC OF TRANSFUSION.—A suitable donor selected, one of three methods may be chosen for the transference of the blood—some one of the syringe methods, the Kimpton-Brown tube, or the citrate method.

The Syringe Method.—Lindeman deserves credit for reviving and perfecting transfusion of blood by syringe. He used 15 to 20 record syringes each of 20 cc. capacity. Needles were first inserted into convenient veins of the donor and of the recipient. Each syringe in turn was then used first to withdraw blood from the donor; filled, it was passed to the operator at the vein of the recipient, and the blood was injected; the empty syringe was then passed to an assistant who washed it carefully in normal saline solution and placed it within reach of the operator at the vein of the donor for further use. Several modifications of the Lindeman method have been suggested the best of which is that of Unger. He devised a four-way stop cock which connected two syringes with the veins of donor and recipient. One syringe while filling is connected with the vein of the donor. When full the cock is turned and the syringe is emptied through the apparatus into the vein of the recipient. The other syringe is filled with normal saline solution and the assistant keeps a slow steady flow from it, injecting saline first through the recipient's tubing, cannula, and vein, then, while the recipient receives blood, the saline flows through the donor's side of the apparatus. Several extra 20 cc. syringes are kept at hand should the first one clot.

The syringe method has the advantage of introducing whole blood without an added foreign substance. The disadvantages are that a team of operators is necessary to function properly, considerable equipment in either special apparatus or syringes is necessary, and the operation must be somewhat hurried in order that any clotting may be prevented.

Kimpton-Brown tubes are being used satisfactorily. The original tubes have the vein cannula of glass as an integral part of the apparatus, while Vincent's modification has tips ground to fit steel or platinum needles which are inserted into the veins through the skin when possible. With any of the tubes it is important that they be properly prepared. They are first carefully cleaned with water, alcohol, and ether, and then dried. Into each tube is placed a small piece of paraffin, the cork put in place and the tubes are sterilized in the autoclave. After sterilization, and while still hot, they must be removed and rotated so that the paraffin covers every part of

the inside, especially the cannula, and care must be taken that the cannula is not blocked with solidified paraffin. After such preparation the tubes are wrapped in sterile cotton and put aside ready for use.

When transfusion is done the veins of donor and of recipient are cut down upon and ligated, that of the recipient distally, of the donor proximal to the incision. The veins are then carefully washed with sterile saline, dried, sterile liquid paraffin is dropped upon them, and they are opened. The cannula of the collecting tube is inserted into the vein of the donor and blood allowed to flow up into it, the donor opening and closing the hand to increase the flow. When the desired amount of blood has been collected, a clamp is applied to the vein and the cannula withdrawn. The tube is turned partly upon the side to prevent the escape of blood, and the cannula quickly inserted into the vein of the recipient. Blood flow is increased by air pressure made in the upper part of the tube by an ordinary cautery bulb which is attached to a side arm. Kimpton-Brown tubes are usually made of 100 and 250 cc. capacity. If it is desired to give more than the capacity of one tube several tubes are used, a tube being used but once during each transfusion.

Kimpton-Brown tubes also have the advantage of using whole blood without added substances, but they require considerable preparation and one or more assistants. The Vincent modification, using needles, is better in that it does not destroy the vein of donor or recipient each time a transfusion is done.

The Citrate Method.—The citrate method is at present the most widely used for blood transfusion. It is the simplest method, can be carried out by one man without haste and with almost any type of apparatus. It does give more frequent reactions—in 20 to 30 per cent. of cases, as against 5 per cent. for whole blood transfusion. These reactions may be severe and are thought due directly to the added citrate. A few fatalities have been reported and no way of overcoming the difficulty has yet been found. Bernheim says there are two types of cases in which citrate transfusions should not be done. First those who have had an exceptionally severe hemorrhage and are in such a state of shock that a reaction may kill them. Second, those patients who have such an intense anæmia from disease that they are almost dead. He says the syringe method or Kimpton-Brown tubes should be used for these patients because they both utilize unchanged blood and are less likely to give reactions. Nevertheless, the citrate method is an extremely valuable procedure as it makes transfusion of blood so readily available to a much wider circle in the medical profession.

The blood is usually collected in a sterile flask to which sufficient sterile sodium citrate solution has been added at the start to make it of 0.25 per cent. strength when the desired amount of blood has been collected. The citrate solution usually used is 2.5 per cent. strength, and of this solution 10 cc. should be used for each 100 cc. of blood collected. While blood is flowing into the flask it should be gently agitated or stirred with a sterile glass rod to assure thorough mixing of the citrate solution and prevent any

clotting. After collection the blood may be set aside and kept warm until the recipient is ready for its injection. The vein of the recipient is exposed or entered through the skin with a large caliber needle. A sterile glass funnel or arsphenamin burette is then connected to the needle with about four feet of small caliber rubber tubing after the funnel and tube have been filled with normal saline solution to exclude air. Several layers of gauze are placed over the opening of the burette or funnel and the citrated blood is poured through them and allowed to run into the vein of the recipient.

In all of these operations asepsis must be faultless. When citrated blood is used it is best to stop the flow for five minutes, after about 25 cc. of blood have entered the vein, to make sure that no reaction will occur, even when tests have shown that the bloods of donor and recipient were perfectly matched. Symptoms of incompatibility are pain in the back, dyspnoea, abdominal pain or discomfort associated with nausea or vomiting, and puffiness of the face or eyelids.

ii. The Primary Anæmias.

The causative factors involved in the production of the primary anæmias are unknown. There are three distinct types of primary anæmia, —pernicious anæmia, in which there is an increased destruction of the red blood cells, aplastic anæmia, with failure of the red cell production, and chlorosis in which there appears to be an abnormality in the iron metabolism.

(a) CHLOROSIS.

The disease is seen only in girls, and the age at onset approximates that of puberty. The cause is entirely unknown, but important factors bearing upon its incidence, and therefore to be corrected, are poor hygiene, deficient or badly balanced diet, and chronic constipation. The disease is quite rare, and the diagnosis should be made only after careful exclusion of obscure causes of a secondary anæmia, especially of slow bleeding from a gastric or duodenal ulcer.

Treatment.—**General Management.**—The hygienic and dietary habits must usually be corrected. The patient should get plenty of fresh air and sunshine, and, as she grows stronger, exercise in the open. Adequate sleep should be insisted upon, at least nine hours each night for a girl of 15 to 20 years of age.

The bowels should move daily. It is best to regulate an existing constipation by dietary changes especially increasing the amounts of the green vegetables, which also contain relatively large amounts of iron. Should a change in diet be insufficient the daily bowel movement should be secured by a laxative.

DIET.—The food offered should be simple, nourishing, easily digestible and attractively served. The iron content of the various articles should be considered in the selection. There may be complaint of indigestion which is of the type of hyperacidity, and it may then be necessary to modify the

diet as has been described in the section on diseases of the stomach. Hyperacidity may also be relieved by the administration of sodium bicarbonate, given one-half hour to one hour after meals, or, if there is constipation, magnesium carbonate or magnesium oxide may be prescribed.

DRUGS.—Iron is the best remedy and may be said to be a specific. Bland's pill, freshly prepared, in doses of 0.1 to 0.3 gram (2 to 5 grains), after meals is as good as any other preparation for oral use, and usually gives satisfactory results. The citrate of iron is used hypodermatically, 0.06 to 0.1 gram (1 to 2 grains) once daily.

(b) PERNICIOUS ANÆMIA.

In pernicious anæmia it is generally agreed that there is an increased blood destruction due to some unknown toxæmia, and that the bone marrow changes are an hypertrophy of erythroblastic tissues in the effort to meet the increased demand for cells. That cure occurs is improbable though it has been reported.

Treatment.—Based upon various theories as to the cause of pernicious anæmia, a number of drugs, dietary measures, and other procedures have been suggested from time to time. None has been found to cure the disease, and the best that may be said is that remissions have apparently been brought about, and the patient given a new lease on life. Even this is an optimistic view to take of the treatments suggested, as cases are known in which, with the patient comatose, a spontaneous remission has come about without any special treatment.

General Management.—When the anæmia is severe the patient should be in bed, and should be allowed all the fresh air and sunshine possible. It is best to avoid, when possible the severe cold of the Northern winter, and in any weather other than midsummer, the patient should be more warmly clothed than usual.

Because of the atrophy of the gastric and intestinal mucous membrane the diet should be simple, well cooked and finely divided. It may be general but when there is constipation, puréed green vegetables and cooked fruits may be given. Frequently it is advisable to give dilute hydrochloric acid with or after meals.

Focal infection was at one time brought forward as the cause of pernicious anæmia but the evidence that such chronic infections are etiological factors is inconclusive. In any case of pernicious anæmia it is advisable to eliminate a chronic infection if it requires no more severe operative work than tooth extraction for apical abscess or the treatment of pyorrhœa.

DRUGS.—Arsenic is warmly recommended by many clinicians. It is usually administered as Fowler's solution, at first in doses of two or three drops after meals, to be gradually increased until minor symptoms of poisoning occur. Sodium cacodylate (sodium dimethylarsenate) may be used hypodermatically. Arsphenamin has been used but no better results are seen than those obtained by the oral administration of liquor potassii arsenitis.

TRANSFUSION.—The transfusion of whole blood will produce at least temporary benefit, and is at times the apparent starting point for a remission. Its effects are especially beneficial in the early cases but it is practically always to be regarded as a temporary expedient. Depending upon the benefit derived and its duration, transfusion may be repeated a number of times. Some cases have been reported as cures after a number of transfusions but as remissions of ten years are not uncommon without any special treatment one can not yet be too sanguine of the efficacy of the injection of whole blood. Lately there have been several reports of severe reactions somewhat like anaphylactic phenomena following repeated transfusions.

SPLENECTOMY.—Giffin and Szlapka have reported upon the results of splenectomy in some fifty cases of pernicious anæmia from the Mayo Clinic. They believed the operation prolonged life in one-fifth of the cases. The immediate operative mortality was 6 per cent. Ten of the patients lived three years after operation, and five were living nearly six years afterward. Minot and Lee have the impression that the cases with large spleens derive more benefit from splenectomy than those in which the spleen can not be palpated.

(c) APLASTIC ANÆMIA.

There are cases of apparent aplastic anæmia in which benzol or the x-ray is the causative factor, and these patients will usually recover when the cause is removed. The cause in the typical case is unknown. In the idiopathic type repeated transfusion may postpone death for a few weeks and the operation is certainly justifiable in all cases but can only be regarded as an expedient.

II. POLYCYTHÆMIA.

The various forms of polycythemia are difficult to classify. When a definite cause can be assigned such as congenital heart disease, chronic pulmonary disease, or some of the industrial poisons, the patient may improve upon treatment directed at the primary condition, but in the erythremias, where no apparent cause is to be found the treatment is entirely symptomatic and directed at reducing the number of red blood cells and the excessive amount of circulating fluid.

Treatment.—The most rapid relief from the headaches and vertigo is by venesection, 500 to 1000 cc. (16 to 32 ounces) of blood being withdrawn. Such relief is only temporary but it may be repeated as necessary.

X-ray exposure of the spleen has been tried in a number of cases and occasionally with beneficial results, not only in reducing the red blood count but in relieving symptoms. In one case under my observation the erythrocytes came within normal limits after exposure of the spleen to x-ray, but the symptomatic improvement was doubtful.

Benzol has been suggested. It should be cautiously administered and close watch of the leucocyte count must be kept. The drug is a poison to the hematopoietic tissues and if continued for too long a period blood formation may cease entirely.

Gangrene of the toes, which occasionally occurs in these patients, responds best to rest in bed, and the continuous application of dry heat. Some form of electric lamp radiator which may safely be placed under the bed clothing is best.

III. LEUKÆMIA.

In the acute leukæmias, both of the lymphoid and myelogenous types, but little can be done. The disease seems like an exceptionally virulent infection which often kills within a few weeks. Hemorrhages in these forms may be controlled by intramuscular injection of serum, or better, by the transfusion of whole blood, but this is usually but a temporary expedient.

The chronic forms are more amenable to treatment and perhaps the myelogenous variety responds better than the lymphatic. Some form of radiotherapy has given the best results.

Treatment.—**X-ray.**—The application of x-rays over the spleen, long bones, and lymph glands has been in use for a number of years. Its use is gradually being perfected, and the dosage and action more fully understood. The spleen shrinks remarkably and the leucocyte count drops usually quite rapidly. Treatment should cease when a level of 20,000 leucocytes per cmm. of blood is reached. X-ray in excess may give severe reactions and result in an aplastic condition of the bone marrow, while an insufficient amount may act as a stimulant to the abnormal bone marrow activity. Pancoast advises that the bones be treated systematically first, and, as improvement occurs, the spleen and lymph glands be exposed.

Radium.—Wood has used radium in a number of cases with distinct improvement. The spleen is mapped out in small areas and these are in turn daily exposed to filtered rays of radium. There is not only improvement of the blood picture and shrinking of the spleen, but the patient feels better.

With regard to the use of both x-rays and radium the warning should be given that these agents are capable of great harm, and of reactions which may be directly fatal. They should be used only by men who have had long experience with them in general, and who are familiar with their use in the diseases in question.

Drugs.—The drugs of most value in the treatment of leukæmia are arsenic and benzol.

Arsenic is best administered as Fowler's solution, and should be given to the point of tolerance. Some cases which are refractory to x-ray alone may improve markedly if arsenic be administered at the same time. Most of these patients have considerable anæmia and arsenic will help improve the red count and hemoglobin.

Benzol.—Benzol has been used for a number of years and in some cases is of marked temporary benefit. The patient must be kept under close observation, and when the white blood cells have fallen to 20,000 or 25,000 the drug should be stopped. Benzol is a poison to the hematopoietic system, and there will often be an anæmia following its use. For the same reason it cannot be continued for too long a period as the formation of erythrocytes may fail entirely. The dose is 0.3 to 0.6 cc. (5 to 10 minims) mixed with equal parts of olive oil and dropped into an ordinary gelatin capsule before ingestion.

Thorium-X.—Vogel says thorium-x either by mouth or intravenously is dangerous and should not be used.

Transfusion.—Transfusion is valuable if there is hemorrhage or a marked anæmia. It has no influence upon the progress of the disease.

Splenectomy.—Removal of the spleen has been usually unsuccessful and in numerous instances has directly resulted in death. Even in those cases which recover from the operation there has been no effect upon the progress of the disease.

IV. HODGKIN'S DISEASE.

The cause of Hodgkin's disease is unknown, but that it is due to some infectious agent appears probable. As in many cases the lymph glands first enlarged are those of the neck, a primary focus or possible portal of entry may be looked for in the teeth or tonsils. The diagnosis should be made only upon excision of a gland for microscopical study.

Treatment.—When a positive diagnosis has been made early in the disease, with involvement limited to the glands of the neck, either of one or both sides, radical excision of all enlarged glands should be done, and then x-ray or radium treatment of the involved area carried out to prevent any recurrence.

With late general involvement the administration of arsenic or the application of x-rays offers the only hope of relief.

Fowler's solution is administered in increasing doses to the therapeutic tolerance. Sodium cacodylate may be injected hypodermatically in place of arsenic by mouth.

X-rays or radium will usually reduce the size of the glands. Every focus should be exposed to adequate dosage. In these late cases the best that may be hoped for is amelioration of the symptoms. For pain, or distress due to bronchial obstruction morphine should be used freely.

V. DISEASES CHARACTERIZED BY HEMORRHAGE.

i. Purpura.

Purpura occurs in many forms and is frequently but a symptom of an infectious or cachexial disease. The reasons for the occurrence of the hemorrhagic condition are not thoroughly understood. In most forms no abnormality of the blood may be discovered, but in one form a decreased

blood platelet count appears to be definitely related to the hemorrhagic condition. This type is known as purpura hemorrhagica and it is the one usually associated with the most severe hemorrhages.

Treatment.—In any but the mildest cases the patient should be at rest in bed. The diet may be general unless it is necessary to modify it on account of fever or chronic visceral disease. Iron and arsenic may be administered when there is marked anæmia. When there are hemorrhages from the mucous membranes, or extensive hemorrhage into the skin, the subcutaneous or intramuscular injection of 20 to 40 cc. of fresh or citrated blood, daily, or in severe cases several times daily, is often satisfactory. When much blood has been lost it is best to resort at once to transfusion of either fresh whole blood or of citrated blood. The addition of citrate to the blood appears to have no detrimental influence on the benefit experienced from the transference of healthy blood.

Fresh horse serum or even diphtheria antitoxin have been used but they are not as good as the injection of whole blood. Serum should not be injected intravenously because of the reaction which may follow, and it is not more efficient in stopping the bleeding than when administered by the intramuscular route.

Oil of turpentine in doses of 0.6 to 1.0 cc. (10 to 15 minims) three times daily has been highly recommended and certainly seems worth a trial.

If the bleeding be from an accessible point, such as the nose or gums, the local application of epinephrin, or better, of thromboplastin, may be tried.

In the severe types of purpura hemorrhagica it is best to resort to repeated transfusions at once.

ii. Hæmophilia.

The cause of hæmophilia is unknown and all attempts at the discovery of the abnormal element in the delayed coagulation time have failed. The distinct hereditary character of the disease, transmitted through normal females to males who bleed is well known.

Treatment.—The treatment of a spontaneous or traumatic hemorrhage depends upon the extent and location of the wound and of the amount of blood lost. Bleeding from scratches or pin pricks upon the extremities is rarely so severe that it requires more than a pressure bandage. It has been controlled with the ethyl chloride spray and freezing.

Larger wounds should be packed with gauze soaked in thromboplastin when this is available. The gauze may be soaked in normal whole blood or even in fresh horse serum, and pressure applied over the dressing. Fresh blood or serum may be injected into and around the wound, or if bleeding be from the nose or mouth, the normal human blood may be injected intramuscularly in amounts of 20 to 40 cc.

When bleeding has been severe transfusion is most satisfactory. The amount should be large, for an adult 1000 cc. (30 ounces) or more, and if the wound is an extensive one, it is often necessary to repeat the transfusion in

48 to 72 hours. It has been found that after transfusion of a large amount the blood of the hæmophilic will have a nearly normal coagulation time. As time passes after the transfusion the coagulation time lengthens so that in 2 or 3 days it again will take a half hour or longer for the blood to clot.

iii. Hemorrhagic Diseases of the New-Born.

For the types of hemorrhagic diseases in infants known as Buhl's disease and Winckel's disease there is no treatment. Both are fatal.

Morbus Maculosis Neonatorum is a serious affection from which about half the infants affected recover. The cause is unknown. Bleeding is generalized.

The most satisfactory treatment is the transfusion of fresh or of citrated blood when an operator of sufficient skill can be procured. The intramuscular or subcutaneous injection of 20 cc. of fresh human blood is often satisfactory and even fresh horse serum injected may control the bleeding.

VI. DISEASES OF THE SPLEEN.

The anatomical anomalies of the spleen are of little interest to clinical medicine, except in a few rare diseases in which extirpation of the spleen apparently acts as a cure. In these cases accessory spleens may be searched for and removed.

If the spleen becomes displaced, and in such a position that it interferes with the function of other organs it may be sutured in place, or it may be removed.

Acute and chronic splenomegaly are treated according to the condition which has caused the splenic enlargement. When accompanying the acute infectious diseases the spleen usually becomes much smaller as the fever subsides. In subacute blood infections there are usually no symptoms associated with the splenic enlargement and no treatment of the spleen itself is necessary. When due to syphilis or malaria, the administration of the specific drug which is necessary for the cure of these diseases will result in shrinking of the size of the spleen. Splenomegaly associated with the various blood diseases has already been commented upon.

i. Splenic Tumor with Anæmia.

Banti's Disease.

The early recognition of Banti's Disease is important as splenectomy during the first stage of the disease offers excellent chances of complete recovery. Even late in the disease splenectomy greatly improves some patients.

In the late stages when splenectomy does not appear advisable, the treatment is entirely palliative. Iron and arsenic are administered for the anæmia. The peritoneal cavity often requires tapping for the ascites.

In two other types of splenomegaly, extirpation of the spleen is indicated.

Gaucher's Disease.—Gaucher's disease is usually confused with Banti's disease, the correct diagnosis being made when the extirpated

spleen is examined microscopically. If a tentative diagnosis of Gaucher's disease be made extirpation of the spleen offers the best chances of recovery.

Hemolytic Icterus.—It is in the congenital type of hemolytic icterus that splenectomy is most useful. The operative mortality is 5 per cent. or less, but in cases recovering from the operation a cure is practically always the result.

Rupture of the spleen, and the rare cysts and abscesses, for treatment belong to the surgeon. Splenectomy is indicated and the sooner it is done the better.

XV.

THE TREATMENT OF DISEASES OF THE GLANDS OF INTERNAL SECRETION.

J. C. WILSON.

THE endocrine or hormonopoietic glands constitute a system of organs widely distributed anatomically but closely interrelated physiologically. It follows that pathological process or functional derangement of a single member of this great system rarely occurs alone. Endocrine symptoms and signs may enable the clinician to localize the predominant and perhaps the primary disorder in one gland; but frequently two or three others may manifest the evidences of a similar derangement and in many instances, several of the glands of internal secretion may at the same time show indications of disordered function. From the standpoint of treatment, the clinical study of the manifest uniglandular syndrome yields better results when it precedes the investigation of the associated or subordinate multi-glandular syndromes.

As suggested by Timme,¹ our conceptions in regard to endocrinology may be broadened by looking upon the normal life of an individual human being as being divided into three physiologic periods. The first period extends from birth until puberty; the second from puberty to the prime of life; the third from the prime until death. The first is the period of growth and development. It is a period of preparation. The glands chiefly controlling development during this period are, according to this authority, the thymus, which determines the growth of the bony skeleton, and the pineal, which has to do with muscular development. Under the influence of the thymus, while growth is active the sexual development is held in abeyance; if the thymus does not become inactive before or at puberty, the skeletal growth and other infantile characteristics are carried over into the second period, and many of the peculiarities of status thymicolymphaticus are present. When, however, the influence of the thymus is prematurely arrested, the characteristics of childhood are displaced to a greater or less extent by those incident to the second period—retarded skeletal growth,

¹N. Y. Med. Jr., March 2, 1921.

precocious sexuality, self-assertion, excitability, and so on. Early involution of the pineal gland as determined by röntgenograms is attended by muscular asthenia, reaching in some instances extreme types of muscular dystrophy. The second of these periods is physiologically characterized by the manifestations of energy. The first period is a time of preparation; the second a time of use and application. Self-help, self-protection, the rearing of the young are the requirements of this cycle of existence. The bone and brawn made ready in the first period come into use in the second. Sexual impulsion and power, unheeded in the first, are compelling influences in the second, and intellectual powers gradually acquired during the first period are brought into exercise alike in the exhibition of energy and inhibition of desire in the second. This is the period in which the endocrine glands, the normal activity of which throughout life is essential to health, are especially active. These glands are the thyroid, the adrenals and the pituitary. The third period is that of a gradual decline of physiologic activities, in which adjustments have come to pass and the necessitous demands of the earlier periods for a well-regulated balance among the homonopoietic organs cease to be urgent.

There are two schools of thought in regard to endocrinology at the present time. One actuated by the most rigid requirements of the scientific spirit; the other influenced by the desire to utilize every possible suggestion for the purposes of the clinic. The one is conservative to a degree; the other radical to an extreme—a state of affairs very perplexing to the practitioner, but favorable to sound progress. The beginnings of endocrinology had to do with the thyroid, the most accessible of all the glands of internal secretion. In the middle of the last century, Schiff noted that the removal of this organ in the dog was followed by certain symptoms. Later Gull described “a cretinoid change in women.” Subsequently, a definite substantive syndrome was found to be associated with thyroid disease to which Ord gave the name of myxœdema. Kocher (1883) reported that a large proportion of his cases of operation for goitre had been followed by a characteristic train of symptoms for which he suggested the name “Cachexia Strumipriva.” Horsley’s researches resulted in the recognition of the fact that cachexia strumipriva, myxœdema and sporadic cretinism are varying manifestations of the same disease and are caused by loss of function of the thyroid gland. The part played by the tumor (goitre) in the observations was of overwhelming importance. Pressure upon the windpipe had to be relieved, and Kocher and Reverdin accomplished this surgical feat, and in doing so, found the cause of myxœdema, cretinism, and later, tetany. Such were the first steps in the direction of endocrinology. Then Schiff and Horsley found that thyroidectomized animals could be for a time restored to health by transplantation of the glands, and the crowning discovery from the standpoint of treatment was that of Murray, Horsley’s pupil, that thyroid feeding in thyroidless animals and human beings cured the disease and maintained health. This was the beginning of organotherapy. The importance of an internal secretion of the pancreas by the islands of Langer-

hans had long been recognized, together with a theoretical relationship with the thyroid, which of late has assumed greater importance. That there is also a physiological relationship between the hypophysis and other ductless glands is generally admitted. It thus began to be clear that there are polyglandular syndromes. When Starling (1902) suggested the descriptive term "hormone" for certain clinical substances produced in various glands and tissues and capable of arousing or calling into play physiological functions in distant parts and thus showed the interdependence and correlation of functions among these organs, the conception of pluriglandular functional disturbance took definite shape, with the corresponding development of the idea of a pluriglandular therapy.

A new phase of treatment for functional diseases previously rebellious to medical measures, and unhappily too often unresponsive to surgery, claiming a novel scientific basis and remarkable success, at once interested a large public and rapidly gained the support of many intelligent and conscientious physicians, at first in France, and afterwards in England and America. Its advocates spoke of it as the "Medicine of the Future" and justified their enthusiasm by innumerable well authenticated reports of apparent cures. Naturally there were those who made unreasonable claims for a rapidly extending, plausible system and based their conclusions upon unwarranted assumptions and indefensible statements. Despite all this, even those who are most unwilling to endorse the methods by which pluriglandular therapy is promulgated as a system, acknowledge that it rests upon a reasonable, though as yet limited, support of ascertained facts.

On the other hand, the progress of knowledge concerning the functions of the thyroid and hypophysis has been slow and most carefully guarded from step to step, and the medical and surgical means by which their dysfunction can be corrected, when correction is possible, have been developed with the utmost caution.

Pluriglandular therapy has been compared to the Mississippi Company and the South Sea Bubble. But there is no comparison. Those were colossal schemes to defraud credulous people of money; pluriglandular therapy is a comprehensive plan to restore ailing persons to health. One thing they have in common. It has been called mob psychology. On occasion unreflecting persons run together like sheep in droves. And they are almost always wrong. Pluriglandular therapy will come to its own by the use of the principle of the working hypothesis. One reasonable suggestion after another is tried out; when one is found that reacts favorably to most of the facts, the hypothesis becomes a theory. When the theory corresponds to all the facts, it becomes a law. This is the method of the research laboratory. It means a sifting of evidence and checking it up. Great discoveries are rarely made at once. The prospector is not immediately successful. He goes over his claim little by little until at last he finds gold—perhaps not even then.

Those who are opposed to the present aspects of endocrinology are, it seems to the writer, hostile to methods, not hostile to principles. To a

generation which has seen aerial and submarine navigation made practical, wireless telegraphy, malaria and yellow fever controlled, the Panama Canal a success, and coming nearer home, the telephone an indispensable office and household appliance, no proposition is impossible until it is proved to be so. Two things of the spirit have made these things possible—imagination and enthusiasm. But an enthusiasm that knows no defeat must rest upon provable facts, and imagination which is scientific cannot run riot.

I. THYROID GLAND.

i. Acute Thyroiditis.

This subject requires very brief consideration. Applications of cold in the form of compresses or the ice-bag; bits of ice dissolved in the mouth; active saline purgation if not contraindicated by the primary disease; surgical measures if suffocative phenomena develop and the evacuation of pus when formed constitute the treatment. The condition is an alarming complication of acute infectious diseases but it is fortunately extremely rare. There are no specific endocrine manifestations. Subsequent complete atrophy or destruction of the gland by suppuration has been followed by myxœdema.

ii. Sporadic and Endemic Goitre.

General Prophylaxis in Goitrous Districts.—The conclusions of Marine and Kimball¹ based upon systematic studies of the incidence of thyroid enlargement and the prophylactic use of sodium iodide upon a large scale, in the public schools of Akron, Ohio, are of great importance. These observers found that of 2,190 pupils taking 2 gm. of sodium iodide twice a year, five only showed enlargement of the thyroid, while of 2,305 pupils not taking this preventive treatment no less than 495 showed enlargement of the gland. They found further that among 1,182 pupils having enlargement at the first examination, who accepted the treatment, 773 showed a decrease in the size of the thyroid, while of 1,048 pupils who did not take the sodium iodide, 145 thyroids decreased in size. These figures undoubtedly show in a very remarkable manner both the preventive and curative effects of iodine; but the determination of slight variations in the size of the thyroid can scarcely be made with sufficient accuracy to warrant positive conclusions in doubtful cases, a fact which somewhat influences the statistical value of the conclusions without impairing their general importance.

The most convenient and inexpensive manner of administration is sodium iodide in solution or tablet, but the tablets must be protected from moisture and light. Syrup of the iodide of iron and syrup of hydriodic acid may be used. The quantity necessary is very small—an ounce of either of these syrups or two grams of sodium iodide given in a period of two or three weeks twice a year has prevented thyroid enlargement in this mildly

¹ Arch. Int. Med., 1918, xxii, 41.

goitrous district. Even smaller quantities given at a longer period to healthy children and to healthy pregnant women would yield equally good results. Persons suffering from chronic infections, chlorosis, anæmia, osteomalacia, lymphatism and exophthalmia, and the inhabitants of highly goitrous districts would undoubtedly require larger doses. Untoward effects have not been observed.

The prevention of the goitre of adolescence should be regarded as a measure of public health and provided for in the organization of public and private schools. As the result of the teaching, the pupils would be able to carry it out for themselves and it would become a general practice among women during pregnancy.

Individual Prophylaxis.—In goitrous districts the drinking water should be boiled. Iodine should be given as above mentioned. Its occasional employment is not only preventive but in young persons it is also curative.

The so-called endemic or adolescent goitres of non-goitrous regions tend to disappear spontaneously, but they are favorably influenced by the administration of iodine. Their prolonged recurrence at the menstrual period and persistence throughout repeated pregnancies indicates a danger of hyperthyroidism or Graves's disease.

iii. Hyperthyroidism.

This condition is caused by an excessive functional activity of the thyroid gland—an overproduction of thyroxin. It is a cardinal manifestation of exophthalmic goitre, but very commonly occurs independently of that nosological entity. A very large proportion of the cases of hyperthyroidism are unattended by either goitre or exophthalmos. The treatment is not without difficulties. Direct treatment should be always medical in cases in which goitre is not present.

REST both of body and mind is of the first importance. When it is practicable this factor in the treatment should be arranged according to the well-known formula of Weir Mitchell—absence from home, in other and yet comfortable surroundings, with an experienced nurse and a routine of bathing, gentle massage, generous but not too abundant feeding, and light reading or other amusement, fairly rigorous without being irksome. If such a plan cannot be carried out, the nearest practical modification of it may be installed with advantage. The favorable effects are often quickly realized.

THE DIET should be moderate in amount but simple and nutritious. Hyperalimentation is not desirable. The patient should, if possible, be always hungry for the next meal. Foods rich in protein must be avoided. Butcher's meat, fowl, fish and other sea food are to be prohibited. Milk and the mild foods—cream, butter, cheese and buttermilk, with fresh vegetables and fruits, are proper foods. The leaf vegetables in the form of salads are especially desirable. Such a diet contains a relatively large proportion of the necessary mineral constituents of the natural foods in an easily assimilable state and constitutes a better continuous safeguard against

acidosis than alkali in the form of drugs. The importance of thorough mastication of the food should be urged, and appetite should be encouraged by frequent changes of the articles of food and care in its preparation. The moderate use of fats and carbohydrates is essential. Coffee, tea, meat extracts and all sorts of alcoholic beverages are inadvisable. A glass of hot milk or malted milk at night is often useful when there is a tendency to insomnia. Constipation is to be avoided.

MEDICINAL SEDATIVES should be given for a time; but they are to be abandoned as improvement takes place. The bromides of which the strontium salt is the best, dionin, zinc valerianate; very small doses, 0.00015 grain ($\frac{1}{400}$ grain) of hyoscine hydrobromide, are all good. Quinine hydrobromide in full doses is credited with the power to reduce an inordinate pulse-frequency.

INFECTION.—Meanwhile the search for infections must be instituted. Syphilis and tuberculosis must receive appropriate treatment. It is, however, focal infection that can often be arrested at its source that plays the most frequent and important part. Many patients are relieved by the work of the dentist, the specialist in nose and throat diseases, the gynecologist and the surgeon operating upon distant organs as the gall bladder, appendix or prostate, and in a short time regain their health under the medical treatment outlined above. Many more, failing to receive such treatment at the hands of the judicious specialist, fail of benefit by medical means and too often also fail of benefit from operations upon the thyroid.

MEASURES OF HYDROTHERAPY.—Warm baths at night and gentle cold frictions in the morning; hot and cold packs according to the sensations of the patients at intervals of two or three days tend to quiet the overacting heart and the irritated nervous system. Colonic lavage every day or every second day is a useful hygienic measure.

The effect of treatment and the progress of the individual case must, when practicable, be checked off by systematic determinations of the basal metabolism. A considerable proportion of cases show a remarkable improvement under the above treatment and are regarded as restored to health, but the improvement is not always lasting.

The literature abounds in favorable reports of the successful treatment of hyperthyroidism by organotherapy. The liquor hypophysis U. S. P. by hypodermic injection in daily doses of 3 to 5 minims, on account of its power to reduce the pulse-frequency, thymus, which Hawk¹ in studies upon the metabolism in goitre found to appear to depress the stimulating effect upon metabolism (caused by thyroid excess) which "supports the view of a possible antagonistic action of these glands as has been suggested by others on the basis of indirect evidence," anterior pituitary, corpus luteum, pancreas, adrenal and thyroid itself are substances employed.

iv. Adenomatous Goitre.

In the words of Plummer,¹ "the status of the hyperfunctionating adenomatous goitre is the result of a pure hyperthyroidism." Of the two theories in regard to hyperfunctionating adenomatous goitre, namely that the adenomatous tissue elaborates and delivers an excess of thyroxin, and second, that the adenoma in some way stimulates the surrounding thyroid tissue to hyperfunction, the former appears more probable. There is apparently "no doubt that the adenomatous tissue actually elaborates thyroxin and stores colloid and iodine." The administration of iodine in small amounts may prevent the development of colloid goitre; it may equally prevent the formation of the adenomatous goitre of adolescence. This being the case, the prevention of adolescent goitre means also the control of adenomatous goitre. Goitres of this type associated with hyperthyroidism, not benefited by medical treatment, even though not increasing in size, or causing pressure symptoms, should be resected. The adenomatous tumors may be recognized on inspection and palpation as definite nodular boss-like masses projecting from the surface of the enlarged thyroid and often tender upon pressure. They develop from prenatal tissue and do not usually become active as secreting structures until about the third decade of life, although they are often palpable at the age of puberty. When they become active to the point of hyperthyroidism, remarkable improvement usually follows complete resection of the adenomatous tissue. If small adenomatous tumors are distributed throughout the thyroid tissue and are inaccessible at operation, the symptoms are likely to recur; but they may be controlled by the administration of thyroxin from time to time.

v. Exophthalmic Goitre.

The hyperthyroidism is associated with diffuse hyperplasia of the thyroid gland. The tumor is bilobar and does not usually present the circumscribed enlargement prominent in adenomatous goitre. The general appearance of the patient is characteristic and striking and the symptoms are often severe. The pulse frequency amounts to a positive tachycardia, often 140 to 180 per minute.

GENERAL MEDICAL TREATMENT as above mentioned must be instituted at once and carried out with energy. A majority of the cases come on insidiously and the patient, while feeling much out of sorts and weak, does not regard herself as positively ill until some unusual stress or profound emotional shock suddenly aggravates the symptoms. Even then it is often difficult to institute proper treatment.

RÖNTGENOTHERAPY should be early employed. The theoretical considerations and the technical procedure must be left to the experts. There is

¹Jr. A.M.A., July 23, 1921. Address of the Chairman of the Section on the Practice of Medicine, read before the joint meeting of the Section on the Practice of Medicine, the Section on Pharmacology and Therapeutics, and the Section on Pathology and Physiology at the Seventy-second Annual Session of the American Medical Association, Boston, June, 1921.

The reader is referred to this admirable article in which the recent work upon the thyroid gland at the Mayo Clinic is very fully considered.

much uncertainty as to the mode of action and great difference of opinion as to the details of treatment. The concensus of opinion, however, is that, properly used, this method of treatment is frequently followed by very favorable results and some observers have reported 50 per cent. of symptomatic cures, the patients having remained well and resumed their usual occupations. In the cases which do not respond favorably, the employment of x-ray treatment is now regarded as a useful preparatory measure before operation. Determinations of the basal metabolism have shown that the results are better if the thymus, which is usually persistent and hypertrophied in this condition, is treated at the same time with the thyroid. Radium has been used recently in place of the Röntgen rays, and with equally favorable results. It is more convenient of application, and somewhat more rapid in its action.

SURGERY.—While there is a general agreement among writers that well-developed adenomatous goitres should be treated surgically by the excision of the adenomatous tissue even to the extent, if necessary, of three-quarters or more of the thyroid gland, there is great difference of opinion as to operation in the treatment of the hyperplastic thyroid of exophthalmic goitre. Many surgeons still hold that the enlarged thyroid should be removed at once in part or greater part; others hope for benefit by ligation; later excision; again, many remove a lobe at first and later the other lobe. I am not now speaking of the necessity of sparing parathyroid tissue.

The recent intensive studies of many workers upon the subject of the treatment of exophthalmic goitre have established the following facts: That the end results are equally as good with röntgenotherapy as with surgery. That there is an operative mortality, however small, with surgery; none with x-ray treatment; the x-ray treatment of the thymus with the thyroid should be employed in cases not yielding to medical measures, with surgery later if necessary.

Whatever the treatment may be, basal metabolism determinations are necessary to a satisfactory knowledge of the effects of treatment and the progress of the disease.

“Toxic goitre” and “Thyrotoxicosis” are misleading terms because they suggest particular types of disease. All forms of thyroid disease associated with a pathogenic excess or a pathogenic deficiency of the thyroid secretion of thyroxin are, in a certain sense, toxic; some less so, some more. It is not therefore necessary to regard the extreme cases as representing any special type. To do so adds to the difficulties of a subject essentially difficult in itself.

Ochsner's patients when discharged receive the following instructions as to diet and mode of living:

1. You should avoid all excitement or irritation like attending receptions, shopping, church work, or politics.
2. You should get an abundance of rest by going to bed early and taking a nap after luncheon.

3. You should have an abundance of fresh air at night, consequently you should sleep with wide-open windows or on a sleeping porch.

4. You should eat and drink nothing that irritates the nervous system like tea, coffee, or alcohol. Of course, you should not use tobacco in any way.

5. You should eat very little meat. If you are very fond of meat, take a little beef, mutton, or breast of chicken, or fresh fish once or twice a week, or at most, three times a week.

6. You should drink a great deal of milk or eat things that are prepared with milk, such as milk soup, milk toast, etc.; cream and butter-milk are especially good for you.

7. You should avoid beef soup or beef tea, or any kind of meat broths.

8. You should eat an abundance of cooked fruits and cooked vegetables or very ripe raw fruits, or drink fruit juices prepared out of ripe fruits.

9. You may eat eggs, bread, butter, toast, rice, cereals.

10. You should drink an abundance of good drinking water, or if this is not available, you should boil your drinking water for twenty minutes, or drink distilled water.

The views of the Vienna school in regard to the autonomic nervous system enter largely into the consideration of Graves's disease. There are those who attribute the symptoms directly to disturbances of this system and seek to explain the variations in the clinical manifestations by the predominance of sympathicotonic influences in some cases and deranged vagotonic action in others, and see in a very large group of so-called mixed cases the evidences of disturbed function in both. In the words of Cushing, "whether we will get very far with an analysis of sympathicotonic versus vagotonic states without a better understanding of normal function is somewhat doubtful, and the subject has become almost too complicated for ordinary understanding."

vi. Hypothyroidism.

Prophylaxis.—In the present state of knowledge, there is no preventive treatment save that in the surgical treatment of goitre some portion of the gland should be allowed to remain. If there are accessory glands total extirpation of the thyroid is not followed by myxœdema. The patients are very sensitive to cold and should, if not relieved by treatment, take up a residence in a warm climate. Warm clothing is necessary and habitual warm bathing is a useful adjuvant to treatment.

Causal Treatment.—The proper administration of thyroid substance or its chemical content, thyroxin, constitutes one of the most brilliant achievements of the art of medicine and amounts to a positive cure in a majority of the cases. That it is a replacement cure is shown by the fact that the remedy must be continued in small doses for an indefinite period,

or at repeated intervals. The life history of the first patient suffering from myxœdema treated by thyroid extract has recently been published by Murray¹. The patient was the mother of nine children. It was noticed by her friends when she was about 41 to 42 years old that she had become slow of speech and action, and she complained that she could only accomplish her ordinary housework by unusual effort. At the same time her features were noticed to have changed; they had become thickened and altered in shape. When first seen by the writer of the communication, she presented the typical appearance of an advanced case of myxœdema. She was treated with extract of thyroid, regained her health, and lived in good health for over twenty-eight years, "during which period she consumed over nine pints of liquid thyroid extract or its equivalent prepared from the thyroid glands of more than 870 sheep."

The results of thyroid treatment in cretins, particularly when instituted early, are astonishing. Within a few months the child formerly presenting all the appearances of idiocy manifests the traits of bodily and mental health. The disfiguring obesity diminishes, the skin becomes moist, the urine is increased, the temperature rises to normal, the pulse rate quickens and the mental condition improves to a remarkable degree. Many of these cases are thyroidless; in others postmortem findings show an almost complete absence of glandular tissue. The administration of thyroid must therefore be continued indefinitely, and the term "thyroid feeding" acquires a suggestive significance.

Many preparations are found in the shops. The thyroid glands of sheep "freed from connective tissue and fat, dried and powdered and containing not less than 0.17 per cent., nor more than 0.23 per cent. of iodine in thyroid combination," are officially recognized in the pharmacopœias. One part of *thyroideum siccum* represents approximately 5 to 6 parts of the fresh gland. It should be carefully standardized. The average dose for an adult is 0.1 gram ($1\frac{1}{2}$ grains); but the dose varies within wide ranges and must be regulated by the effect. A small dose two or three times a day may be sufficient; a slightly larger dose once a day, or a larger dose at longer intervals, since the active principle of the thyroid secretion is stored up in the tissues and used as needed.

THYROXIN.—This principle is now marketed in tablets of different strengths for administration by the mouth. These tablets contain doses varying from 0.2 milligrams to 2 milligrams. They should be taken fasting and followed by a draught of water. The initial dose should be small and the evidences of "thyroidism" should be watched for. These are cutaneous irritation, restlessness, nervousness, increased pulse frequency and delirium.

The physiologic reaction following the administration of thyroxin is the same as that following the administration of the fresh or dessicated thyroid gland. There are approximately 10 mg. of thyroxin in 150 grams of dessicated thyroid. Thyroxin can be given intravenously and thus in using it the uncertainties attending the employment of the dessicated gland are

¹ Brit. Med. Jr., Mar. 13, 1920.

avoided. The daily dose of 1.6 mg. thyroxin given by the mouth is sufficient to hold the basal metabolism of thyroidless individuals within normal limits.

The basal metabolism in thyroidless individuals bears a fairly definite relation to the occurrence of oedema. It is usually about 30 to 40 per cent. below the average normal and is not attended during rest with oedema, which may, however, appear after effort and subside upon rest. Continued stress impairs the supply of thyroxin and the basal metabolism falls. A fluctuation of one mg. or even less in the tissues may be attended by the appearance and disappearance of oedema. It is of diagnostic importance that a drop in the basal metabolism to 40 per cent. below normal does not cause oedema in conditions not due primarily to hypothyroidism (Plummer).

The indications for the therapeutic use of thyroid extract and thyroxin, which is obtained from it, are all forms of myxoedema—that of adults, cretinism and postoperative. Since the degree of hypothyroidism as a syndrome of diminution of thyroid secretory efficiency varies from a mere imbalance to absolute arrest as in congenital thyroidlessness or complete resection of the gland or its entire atrophy following the destructive suppuration of acute thyroiditis, there is a wide range of intensity in the clinical manifestations. It is in the milder types, not always easily recognizable, that are found equally important indications for small doses of the curative principle. As the physiological functions of the thyroid as a regulator of the metabolic processes of the body involve the greater part, if not all, of the tissues and organs, and are correlated with the other endocrine members of the hormonopoietic system either in acceleration or inhibition, it is probable that a very large number of ill-defined functional disorders are the result of slight and perhaps transient degrees of hypothyroidism. Among these minor forms are retarded growth and development, abnormally formed teeth, a dry, harsh skin, scanty hair, subnormal temperature and mental dulness. Children who have feeble circulation, cold hands and feet, and are always tired are often benefited by small doses of thyroid. Children abnormally fat are said to be favorably affected by small doses of thyroid with pituitary. Delayed development of the secondary sexual characteristics in girls, particularly when associated with chlorosis, is an indication for the use of thyroid and ovarian extract; and amenorrhœa and irregular menstruation are often corrected by thyroid in association with ovarian preparations. This combination of endocrine principles is especially useful in the troubles incident to the menopause and the succeeding period during which physiologic adjustments are taking place. The obesity so common at this epoch is usually a symptom of hypothyroidism and constitutes a clear indication for the thyro-ovarian combination. In the obesity due to too much food and too little exercise, especially where the tendency is hereditary endocrine treatment is contraindicated and attended by the danger of hyperthyroidism. Thyroid extract has been much used in a wide range of wholly different diseases of the skin with inconstant results. There are very few exceptions to the rule that the thyroid preparations are wholly contraindicated in forms of hyperthyroidism.

II. THE PARATHYROID GLANDS.

Whether or not there are clinical manifestations caused by an abnormal increase in the secretory function of these bodies has not been determined.

Tetany.—There are, however, abundant experimental studies and clinical observations demonstrating the powerful physiologic influence which they exert upon calcium metabolism and in the control of the action of certain endogenous poisons which cause the symptom-complex known as tetany. It is now established that, not only in human beings, but also in a large group of animals used for laboratory research, comprising dogs, cats, rats, mice, rabbits, frogs, goats, monkeys and hens, the extirpation or destruction of the parathyroid glands is followed by symptoms of acute or chronic tetany. Early in the surgery of the thyroid, it was found that the removal of the thyroid and the parathyroids at the same time caused tetany with myxœdema; the removal of three parathyroids without the thyroid caused tetany without myxœdema, and that the removal of the thyroid without the parathyroids caused myxœdema but not tetany. There are rare exceptions to these general conclusions which are to be explained by the occasional presence of supernumerary thyroids and parathyroids which may be overlooked alike in clinical and experimental work.

The development of post operative tetanoid symptoms can be immediately arrested, as was shown by MacCallum, by the intravenous injection of a 5 per cent. solution of the acetate or lactate of calcium. In the course of twenty-four hours the tetanoid manifestations return but can be again controlled by the injection of the calcium salt. Similar results follow the intravenous injection of a saline parathyroid extract or the transplantation or feeding of parathyroid. These measures are, however, not lasting. The assumption that the symptoms following parathyroidectomy are due to the action of guanidine or derivatives of guanidine (Noel Paton) and that one of the functions of these glands is to prevent the abnormal accumulation of these prisms in the tissues, has received much attention. This view has led to the hypothesis that a deficiency in the parathyroid secretion is a factor in the etiology of idiopathic tetany. There are various other hypotheses, namely, that acute and chronic tetany may be caused by an auto-intoxication from the intestinal tract; a disturbance of the acid base equilibrium; thymus intoxication; insufficiency in the elaboration of specific ferments. The so-called idiopathic tetany of children bears a close relation to gastrointestinal disorders, the acute febrile infections and rickets. In some of these conditions the parathyroids have been found upon post mortem examinations to be the seat of hemorrhage. It has been asserted that the tetanoid manifestations not uncommon in childhood are due to exhaustion of the function of the parathyroids and the term "spasmophilia" has been suggested to include the paroxysms of pertussis, laryngismus stridulous, infantile convulsions and tetany. The exhaustion of the calcium tissue content in the pregnant woman and in tuberculous conditions has been ascribed to the inability of

the parathyroids to respond to the unusual demands under these circumstances. In the present state of development of surgical technic, post operative tetany should be a very rare condition.

The treatment of tetany is not altogether satisfactory. There is a large group of cases in adults—so-called epidemic tetany, very prevalent in some parts of Europe, especially in winter, sometimes described as rheumatic or workman's tetany, common among young workmen, coming on acutely and lasting with some rise of temperature two or three weeks. Recovery is usual irrespective of therapy, and the fatal issue infrequent. The treatment of these cases is expectant. In the forms of tetany that occur in organic disease of the brain and cord as tumor, syringomyelia, cerebellar cysts, medical treatment is, of course, not curative. The symptoms may be alleviated by the salts of calcium in large doses alternating with the bromides, tolysin, dionin, and the valerianates. The use of parathyroid extract has been highly recommended in paralysis agitans.

The calcium deficit of pregnancy may be made up by the administration of calcium. The same is true in tuberculosis. The lactate and glycerophosphate are available salts. The dose of these preparations is 0.50 to 1 gram—7½ to 15 grains. The simultaneous use of abundant milk and leaf vegetables is recommended.

The infrequent condition of gastric tetany with acute dilatation of the stomach is attended with a high mortality. Repeated lavage with normal salt solution to which very minute amounts of hyclorite is added may be of service. Surgical intervention is to be considered.

In children the underlying condition must be treated. Nerve sedatives—warm baths and spongings, packs, luminal and the bromides, especially the strontium bromide, enter largely into the therapy. But the employment of calcium preferably as the lactate has not only an empirical but also a scientific warranty.

PARATHYROID EXTRACT, the dried and powdered glands of cattle, may be obtained in the shops. The dose of the dessicated gland is from 0.003 to 0.006 gram ($\frac{1}{20}$ to $\frac{1}{10}$ grain) three times a day. The results are not striking even after prolonged use. A purified nucleo-protein solution has been prepared for the treatment of paralysis agitans.

III. THE THYMUS GLAND.

In cases of status thymicolymphaticus the personal hygiene and diet should be carefully regulated. In children such measures are often very useful in improving the general health. Iodine in the form of syrup of iodide of iron or syrup of hydriodic acid is useful, so also is cod liver oil. In this connection the frequent association with rickets is not to be overlooked. When there are indications of insufficiency of the chromaffin system, suprarenal gland substance may be administered.

The enlargement of the thymus yields satisfactorily to treatment by the x-rays or by radium. These applications usually act rapidly and should be

repeated at intervals for a time. Thymectomy is a feasible operation and has been many times successfully performed. It should not, however, be undertaken except for the relief of suffocative symptoms which resist the modern methods of radiotherapy.

IV. HYPOPHYSIS CEREBRI.

The pituitary gland or hypophysis is a small body situated at the base of the brain in the sella turcica. It is of complex anatomic organization, consisting of three parts, an anterior larger lobe, which constitutes the main bulk of the organ, and is glandular in structure; a posterior smaller lobe, sometimes called the infundibular portion, which is composed of neural tissue, and the pars intermedia, which consists of a thin epithelial layer, closely investing the neural lobe and in some cases even extending into its tissue. A colloid material is normally present in the pars intermedia. This material has not been found to contain any demonstrable active principle.

The physiologic functions of the hypophysis are as diversified as its structure is complex.

Complete removal or destruction of the hypophysis in animals is followed by a definite train of symptoms—tremor, fibrillary twitchings, opisthotonos, feeble cardiac action, lowered pulse rate, falling temperature, apathy, coma and death. Removal of the anterior lobe is followed by the same results. Removal of the posterior lobe does not cause the death of the animal. If a portion of the anterior lobe is removed in animals, the following conditions result; lowered temperature, slowing of the pulse, increased sugar tolerance, obesity, hypoplasia of the gonads, retardation of growth, apathy and polyuria and sometimes glycosuria. An active principle has been isolated from the anterior lobe to which the influence of the organ upon growth has been attributed. This substance has been called tethelin.

The general term "dyspituitarism" is descriptive of these phenomena.

When the gland undergoes hyperplastic changes or is the seat of tumor formation or cysts, pressure or neighborhood symptoms occur. These are at first immediate or local. With an increasing pressure the symptoms become general and include severe continuous or paroxysmal headache, vomiting, vertigo, ataxia, progressive narrowing of the visual fields and optic atrophy.

The excision of a portion of the anterior portion of the gland, tumor pressure, and various pathological conditions affecting it are often associated with hypertrophy of the thyroid or disturbance of its function. Conversely after excision of the thyroid the anterior lobe of the hypophysis hypertrophies. Friedman,¹ whose studies indicate that there exists "a certain degree of hypophysial hyperactivity in hyperthyroid and of hypoadactivity of the pituitary in hypothyroid states," concludes that the following symptoms and signs of Graves's disease may be in part attributed to hypophysial overactivity.

¹N. Y. Med. Jr., March 2, 1921.

"The increased metabolic rate, especially emaciation, the tendency to glycosuria; mental irritability, especially insomnia, intestinal spasticity, the tendency to miscarriages, skeletal growth, especially acceleration of epiphyseal closure."

And that the following symptoms and signs of myxœdema may be attributed to hypophysial underactivity:

"The decreased metabolic rate, respectively adiposity; higher sugar tolerance and absence of glycosuria; mental depression, respectively somnolence; intestinal atony; rarity of miscarriage; skeletal growth; retardation of epiphyseal closure.

Pituitary products therefore should be contraindicated in the treatment of exophthalmic goitre patients and indicated in addition to thyroid in myxœdematous subjects."

Posterior lobe hypophysial extracts exhibit the following properties: They increase the blood pressure; act as neuro-muscular stimulants, especially affecting unstriated muscular fibre, increasing uterine contractions and promoting intestinal peristalsis; they regulate sugar metabolism, indicating an overactivity by glycosuria, an underactivity by increased sugar tolerance. The polyuria is due to their action in increasing the blood-pressure, lowering the pulse and a digitalis-like influence upon the cardiac musculature. Tumors involving the posterior lobe are associated with diabetes insipidus. The stimulant influence upon muscular tissue in hypophysis extracts is attributed to histamin, which is active in exceedingly small doses. The present knowledge concerning this substance is limited.

Overfunction of the hypophysis in the period of development, before the epiphyseal ossification of the long bones, causes gigantism; when it occurs later in life it results in acromegaly (q.v.); underfunction from any cause is followed by the development of the condition known as Froelich's syndrome or hypophysial dystrophia adiposogenitalis (q.v.).

Treatment.—The indications for treatment are not very satisfactory. Cushing, master of operative technic, has had brilliant surgical successes. The partial removal of a growth or the evacuation of a cyst under favorable circumstances may alleviate urgent pressure symptoms and save the optic nerves from pressure atrophy. Less difficult operative procedure may afford relief by general decompression. Definite developmental syndromes, gigantism and acromegaly; infantilism and dwarfism come under observation too late to be rectified or even arrested, in the sense of any approach to normal conditions, by the action of agents designed to correct disordered hypophysial secretion in diminishing the results of hyperactivity on the one hand, or overcoming those caused by hypoactivity on the other. In well-developed cases success in these respects is not to be hoped for. In early suspected cases, if such were to come under observation the appropriate extracts might be tried with perseverance. Syphilis should be thought of in all cases, and proper diagnostic and therapeutic procedures instituted. In the cases of repeated negative reactions to the Wassermann test and an uncertain anamnesis, efficient antiluetic treatment should be carried out.

Anterior pituitary extract in combination with ovarian and the appropriate gonoid extracts, has been used in Froelich's syndrome, with some effect in reducing obesity. Pituitary headache yields to treatment by the extract of the whole gland.

The official LIQUOR HYPOPHYSIS has a wide range of usefulness in general medicine and midwifery. In conditions of cardiac insufficiency with low blood pressure and shock from any cause, it is of great service given hypodermically in doses of one cc. In this connection its diuretic action is also of service. It is in accordance with the recognized physiologic activities of the posterior lobe that the liquor hypophysis is of service in cases of atonic constipation, and especially in the arrested peristalsis with tympanites following abdominal and pelvic operations; in the retention of urine common under the circumstances, and in incontinence of urine from other cause, alike in adults and children. It has been used with advantage in nocturnal enuresis. In diabetes insipidus its action in some cases is comparable to that of a specific. The polyuria is arrested, the inordinate thirst ceases, the headache is relieved. The decrease in the urine is accompanied by a corresponding rise in specific gravity. The treatment must, however, be repeated at intervals to maintain the relief and cannot be regarded as curative unless the dyspituitarism or other brain condition causing the excessive polyuria becomes inactive coincidentally with the administration of the hypophysial extract—a circumstance not hitherto demonstrated.

The liquor hypophysis may be of service in obstetrics if employed with great caution lest its action may result in laceration of the perineum, the grave accident of rupture of the uterus, or the catastrophe of the death of the child from arrest of placental circulation. It should under no circumstances be administered to a primipara, or when there is any condition on the part of the pelvis of the mother or the measurements of the head or body of the child involving an obstruction to the delivery. It is rarely needed in normal labor and never because the accoucheur is in a hurry.

Under all the foregoing conditions the dose of liquor hypophysis varies from 0.5 to 1 cc. This may be regarded as the average daily dosage; but in urgent cases and under special circumstances the dose may be cautiously repeated once or twice at intervals of a few hours. Sterile ampoules are marketed containing 0.5 to 1 cc. Liquor hypophysis should be used only hypodermically. The prolonged administration of hypophysial extracts has been followed by permanent saccharine diabetes of mild type.

Röntgenographic studies of the sella turcica should be made in the investigation of cases of pituitary disease.

The treatment of hypophysial morbid conditions by radiographic methods has been suggested.

In some cases of epilepsy in childhood, in delayed mental and physical development, in rickets and in cases of unaccountable persistent drowsiness with slow pulse, subnormal temperature and low basal metabolism, extracts of the entire hypophysis in connection with other endocrine

preparations have been recommended and used occasionally with advantage. In this connection it is well to bear in mind the suggestion of Cushing that the hibernation of animals has points of resemblance to acromegaly.

V. EPIPHYSIS CEREBRI.

The pineal gland or epiphysis cerebri is a small body situated in relation to the corpora quadrigemina and attached to the posterior extremity of the roof of the third ventricle. In structure it is composed of a cuticle or glandular layer and an inner or neural portion. It is supposed to possess endocrine functions in early life, to favor muscular development, and control the premature growth and activity of the sex organs and mentality. These functions of the gland appear to gradually diminish toward the period of puberty. Premature involution of this organ is associated with changes in carbohydrate tolerance, varying degrees of muscular asthenia and precocious intellectual and sexual development. Tumors and cysts developing in relation with it cause localizing symptoms and increased intracranial pressure.

A pineal extract has been prepared from young bullocks but the uncertainty as to whether the developmental defects are due to functional derangements of this organ or to other endocrine dysfunction stands in the way of its general use.

VI. SUPRARENAL GLANDS.

Extirpation of these organs causes death in animals by progressive asthenia, both of the muscles and circulation; falling temperature, dyspnoea and convulsions. In certain experiments in which one suprarenal body has been tied off and the other ablated with the expectation of preventing adrenalin from reaching the tissues or blood vessels, the wide distribution of chromaffin tissue throughout the body and in small collections at the bifurcations of large blood vessels has been overlooked. It has been estimated that if one-eighth of the gland is allowed to remain, the animal may survive.

EPINEPHRIN.—The peculiar function of the medullary portion of the gland is to furnish an internal secretion containing the blood pressure raising principle known as epinephrin, which acts on the neuro-muscular elements in the arterioles, increases muscular activity in general and in some way influences the distribution of cutaneous pigment. This principle is described under the various names, suprarenin, adrenin and adrenalin. It raises the blood pressure when injected in minute quantities by constricting the arterioles and lowers the pulse rate by acting on the vagus. In larger amounts it causes dilatation of the blood vessels. It also acts when introduced into the conjunctival sac as a mydriatic. It causes an increased secretion of the salivary and buccal glands, and when injected in sufficient doses induces glycosuria. The action of epinephrin upon the liver function increases the amount of glycogen in the blood and is the occasion of the general feeling of augmented muscular power after its administration. This

fact has lead to a widely accepted view that adrenal insufficiency is largely concerned in the asthenia that attends the acute infections, tuberculosis and many wasting diseases. Epinephrin has been found to be present in the chromaffin bodies. It has been assumed that the continuous output of this principle is not required to maintain the normal blood pressure but that its availability when required to keep up the vascular tone is thus provided for.

The mechanism by which epinephrin controls the pigment metabolism is unknown; but that a varying degree of pigmentation is present in many wasting diseases, forms of tuberculosis, especially those involving the lymphatic structures, in aneurisms of the abdominal vessels, and in conditions in which lesions of the adrenals have been found post mortem, clearly establishes a causative agency.

Knowledge concerning the functions of the cortex is less definite. It has been found to be much thickened in pregnant animals and the inference from this fact that it plays some part in sexual activities and pregnancy is warranted. It has furthermore been established that hyperplasia of the cortex may be associated with precocious sexual development, while hypoplasia may be present in delayed sexual development as infantilism. It is also thought that the cortex produces substances which neutralize the toxæmias of various focal and general infections.

In man the suprarenal bodies represent a fusion of two anatomic structures which in some of the lower animals are entirely separate; the chromaffin tissue system of which the medulla forms a part and the interrenal tissue system of which the cortex is part. It is to this complex structure that the diversified functions of the adrenals are due. In general terms it may be stated that overfunction of the chromaffin tissue system is not associated with well characterized symptoms. It has been suggested, among many other conditions, as an etiological factor in the causation of chronic arterial hypertension. Underfunction of this system is manifested in a high degree in Addison's disease and to a varying extent in emotional and physical depression of every kind, and particularly in the asthenia and vascular hypotension of exhausting acute and chronic diseases. It has been assumed that in these conditions the normal tonic influence of the medullary substance of the suprarenal bodies upon the muscles and blood vessels undergoes a temporary or continuous exhaustion.

In the military movements of the recent war, many cases suggestive of Addison's disease were observed, in which profound asthenia, low blood pressure, gastro-intestinal symptoms, especially diarrhœa, pointed to impaired adrenal function and in which recovery occurred under hospital rest and administration of adrenal substance.

In a corresponding manner there are manifestations of the hyper- and hypofunctions of the interrenal tissue system. In this endocrine domain hyperfunction results in extraordinary perversions of the secondary sex characters, which may manifest themselves as prenatal, acquired juvenile, and adult forms. (See Vol. II, p. 599.) It is quite possible also that less infrequent abnormal sexual manifestations may be related to functional

derangements of the interrenal system; nymphomania and satyriasis to overfunction, and frigidity and indifference to underfunction; while the normal decadence of sexual desire and power is commonly associated with diminished muscular and circulatory tone and other evidences of lowered adrenal activity.

The association of the chromaffin and interrenal tissue elements in the adrenals is so intimate that in the present state of knowledge it is customary to regard these organs as glands of mixed function and to recognize a close association also of their physiological and pathological manifestations. We speak therefore of hyperadrenalism and hypoadrenalism.

i. Hyperadrenalism.

Individuals differ greatly within normal limits in the tonicity of the involuntary muscles, especially those of the circulatory system and of the skeletal muscles, conditions dependent to a great extent upon adrenal efficiency. Well-developed, powerful persons, who have great power of endurance and high capacity for physical and mental work and bear injuries and blood-loss well, owe their good fortune in these respects largely to physiologically active adrenals, and the reverse is true. Among the numerous hypotheses regarding the pathogenesis of gout is that of an increased adrenal activity, associated with an abnormal formation of uric acid. The well-developed fact that many persons experience an unusual feeling of energy and *bien aise* directly before an attack of gout lends countenance to this view. It has been suggested that not only bodily activities are dependent upon a normal adrenal activity but that the latter is also in itself a factor in the causation of wholesome appetite and good digestion. Premature puberty, while usually due to perverted endocrine activity of the ovaries and testicles, is frequently associated with hyperplasia or tumor formation of the adrenals (hypernephroma).

Focal infection, especially those forms which occur in the tonsils and peridental tissues, and various other acute and chronic toxæmias may at first stimulate the adrenals to oversecretion and later cause depression of their function.

Knowledge concerning pathological conditions caused by hyperadrenalism is limited. It has been suggested that chills, which very often follow injections of epinephrin may also be the result of intense stimulation of adrenal secretion, when they occur in the period of onset of acute infections and in the course of malarial disease. This is probable in view of the fact that in many cases, particularly in the periodical fevers, the initial chill is shortly followed by severe physical and mental depression, such as is characteristic of hypoadrenalism. Under these circumstances the sudden overstimulation of these organs results in rapid exhaustion of the epinephrin stored in the medulla and distributed parts of the chromaffin tissue, and an actual though temporary deficiency. It would also appear that the sudden marked asthenia attending the crisis of febrile diseases and the reaction from the hectic febrile paroxysms of advanced phthisis may be of adrenal origin.

Treatment.—The therapeutic indications in hyperadrenalism are not clear. Focal infections require surgical intervention. The measures of preventive medicine to anticipate and prevent infection, the prompt and efficient treatment of acute disease as it occurs, the proper means to protect against sepsis in surgical and obstetrical work, all assume added importance when the danger in these conditions of a transient but repeated adrenal overstimulation that may be followed by a continuous and disastrous underfunction is taken into consideration.

There is unfortunately no satisfactory treatment for the adrenal overaction which manifests itself in precocious puberty. Other sexual irregularities may be ascribed to adrenal oversecretion in association with derangements of the functions of the gonads. The resulting conditions require psychopathic as well as general treatment and not rarely develop into declared psychoses.

ii. Hypoadrenalism.

The adrenal glands exhibit all gradations of impairment of secretory function from the slight and transient insufficiency caused by depressing mental emotions or excessive fatigue showing itself in mental and physical depression, to complete destruction by the fibro-caseous lesions of tuberculosis or malignant disease manifest in the profound asthenia, gastro-intestinal symptoms and dense pigmentation which characterize the terminal condition of Addison's disease. Between these extremes are the cases marked by lack of muscle tone, feeble action of the heart, low blood pressure, digestive symptoms and mental depression which enter into the symptom complex called neurasthenia. More advanced cases are those in which loss of appetite is complete, nausea and vomiting frequent, and so called causeless diarrhoea occasional. With these symptoms are associated great physical and mental depression and a tendency to abnormal pigmentation of the visible mucous surfaces and the skin. From this point it is but a step to the declared Addisonian syndrome (See Vol. II).

Traumatic and post-operative shock are manifestations of adrenal dysfunction; so also are the depression of acute and wasting chronic diseases and the anaphylactic reactions. It is not difficult to understand that the intense emotional and bodily strain of the battlefield may cause shock and lasting disturbance of the adrenals, and that soldiers are frequently picked up deeply shocked under circumstances in which no actual wound or injury has occurred.

The Treatment of Addison's Disease.—As weakness develops, the patient should be kept in bed. There is danger of death from syncope. More commonly it is due to progressive exhaustion. Some of the cases run an acute course, death ensuing in a few weeks. Bronzing is slight or absent in these cases. In these types no treatment is of use except insofar as symptoms and particularly the asthenia may be rendered less distressing by alcohol and opium. Usually the progress is chronic and the disease

may last for years with occasional remissions. In rare instances arrest has taken place and life has been prolonged in a state of valetudinarianism. In these cases a careful personal hygiene, an easily digested and nutritious diet, long hours of sleep and, since the lesions are tuberculous, systematic rest in the open air are recommended. Of drugs those which control and favorably influence the symptoms suggest themselves; as tonics, iron, arsenic and occasional short courses of *nux vomica*; as sedatives to the irritable stomach, *guaiacol*, *hydrocyanic acid*, *dionin* and iced champagne; as measures to control the diarrhoea, which adds to the exhaustion, *bismuth* and preparations of *opium*. Colonic lavage with hot normal salt solution to which a few drops of *hyclorite* are added may be given daily.

GLANDULAR THERAPY.—The fact that tuberculosis is the common cause of the lesions of the suprarenal bodies and that there are frequently extensive cicatricial involvement of the adjacent structures stands in the way of hopeful treatment by adrenal extracts. Many cases have been reported but the proportion of successes is small. The adrenal substance may be given by the mouth and *epinephrin* hypodermically. The dose of the substance is 0.3 to 1.0 gram (5–15 grains) two or three times a day. In the rare favorable cases the general symptoms have improved and the pigmentation has faded.

Sergent's white line, the anæmic vasomotor skin reflex which follows the pressure of the finger nail drawn across the abdomen, has been regarded as a valuable diagnostic sign of adrenal insufficiency. It occurs, however, under circumstances in which other indications of adrenal insufficiency are lacking, as the exanthematous diseases, forms of *urticaria* and various *erythemas*.

VII. THE PANCREAS.

This organ, which has been called the "abdominal salivary gland," belongs to the group of glandular structures which have an external and internal secretion. The first is discharged by ducts into the duodenum and is known as the pancreatic juice. It has to do with the digestion of proteins and starches and acts upon oils and fats causing emulsification and saponification. The second is the product of special cellular bodies, islands of Langerhans, distributed throughout the organ, especially towards its tail, and passes directly into the blood. It is an essential factor in the metabolism of carbohydrates. The extirpation of the pancreas in laboratory animals is followed by glycosuria and death; partial removal by mild diabetes. In human beings diabetes of moderate intensity is relieved by a carbohydrate-free diet; but in the severer forms glycosuria persists. Various diseases of the pancreas are associated with glycosuria; some with actual diabetes.

The posterior lobe of the hypophysis has an important influence on carbohydrate metabolism. Lesions of the adrenals are not followed by glycosuria, but it has frequently been observed after the prolonged administration of *epinephrin* hypodermically. It is of occasional occurrence in

thyroid disease. It is a remarkable fact that the liver, in which glucose is stored in the form of glycogen, may be extensively diseased without causing hyperglycæmia or glycosuria. Diseases of the kidneys are rarely associated with glycosuria. In phlorizin glycosuria, the so-called renal diabetes, there may be a large amount of sugar in the urine but no hyperglycæmia, the sugar being derived from the protein of the renal epithelium. Sugar in the urine occasionally occurs in acute and chronic infections, especially focal infections, after general anæsthesia, in the paroxysms of gout and in various cachexias, but it is usually transient or recurrent. True diabetes sometimes follows sudden profound depressing emotions, great mental strain and worry, or an injury to the head. The foregoing facts show that while pancreatic dysfunction is a necessary factor in the etiology of diabetes, many other conditions may act as causes of glycosuria.

Pancreatic extracts and various preparations of pancreas substance have not proved useful in the treatment of glycosuria and diabetes. Pancreas feeding in the form of sweetbreads has been found alike unavailing.

VIII. THE GONADS.

This term is now very generally employed to designate the essential sexual organs of either sex, as distinguished from the accessory genitals: the sexual glands whether ovary or testis, or both together. These glands not only secrete and discharge the specific reproductive cells—ova and spermatozoa—but they also exert a remarkable influence upon the development of the body and mind. This influence is due not to the reproductive cells, but to other cell groups known in the testes as the interstitial cells of Leydig and in the ovaries as lutein cells. That the influence exerted by these cells is chemical and not primarily nervous was shown by Berthold (1849), who demonstrated that the changes manifested by young cockerels after castration could be prevented by the implantation of the testicles in some distant part of the body, and that young birds thus treated, as they grew to maturity, developed the traits of the normal cock, combativeness, the comb, the sexual instincts and the power of crowing—quite unlike the capon. This experimental contribution to physiology, which anticipated endocrinology by more than half a century, was overlooked, and the view that the chemical processes of the body comprised only constructive and destructive metabolism, the liberation of energy, assimilation, excretion and similar processes, long continued to prevail.

The removal of the testicles and ovaries of animals is performed at the present time to limit reproduction, to make the working animal more docile or to improve the quality of the meat as in capons; in human beings as a surgical operation for the relief of otherwise incurable diseases of the organs in question—as tuberculosis or malignant cystic or other growths involving them.

The physical and mental changes following castration have been known from a remote antiquity. The term eunuch is derived from the Greek

and signifies chamberlain or keeper of the bed. The operation upon males was common among the ancients and is practised among the modern Turks as a means of protection of the harem. It has been a manifestation of religious frenzy in all ages, and at the present time there are religious sects in southeastern Europe who practise it as a rite. In Italy the castration of boys for the purpose of developing the soprano voice was a common practice until a very recent period. Indiscriminate bilateral oöphorectomy in early life for the relief of nervous symptoms has unfortunately been common in recent times. The artificial menopause thus produced is very often attended by the somatic and psychic changes which characterize the physiological menopause.

i. Testicles.

The seminal fluid, which is the external secretion of the organs, is essential to the function of reproduction; but their internal secretion is necessary to the normal development of the secondary sexual characteristics and the mental attributes of the male. When castration is performed in childhood, the penis, the prostate and the seminal vesicles remain small and undeveloped, and sexual desire and power are unknown. There are indications of impairment of other endocrine glands especially the pituitary and the thyroid—adiposity, physical and mental want of normal power, irregular distribution or absence of bodily hair, the retention of infantile characteristics. When castration is done after puberty, the penis and prostate undergo some degree of atrophy, and in most cases there is complete loss of sexual power. Eunuchs are, as a rule, taciturn, lacking in courage and dull; exceptionally they have shown unusual intelligence. Ablation or destructive disease of one testicle, the remaining organ being normal, does not interfere with the normal development of the boy or his power of procreation in manhood. It has been shown experimentally that when both testicles have been destroyed by accident or surgically removed, the transplantation of small uninjured portions into the abdominal muscles or the scrotum (Lydston, of Chicago) may prevent the usual consequences of castration. When possible, the testicles of youths who have been accidentally killed may be used for transplantation. Animal experiments (Voronoff; Steinach) in this field of research have yielded remarkable results. Attempts to utilize testicular extracts by the mouth to postpone the retrograde changes of senility or repair the wastage of excesses have failed.

ii. Ovaries.

The internal secretion of the ovaries is necessary to the normal development of the sexual anatomical and mental characteristics of the female at puberty, in the same manner as the internal secretion of the testicles has to do with corresponding changes in the male. But as the sexual life of the woman is much more complex than that of the man it is to a far higher degree influenced by the activities of other glands with which the gonads are physiologically associated. It is thought that an important function of

the pineal gland is the control of the orderly development of the sex activities, and that an insufficiency of this organ leads to sexual precocity and early menstruation; that hypersecretion of the posterior lobe of the pituitary may give rise to rapid growth of the long bones; hyposecretion to an early arrest of skeletal growth and an excess of fat, and that thyroid dysfunction plays a very important rôle in sexual development in various ways. In fact, from the standpoint of endocrinology the influence of the thyroid upon the physiological activities is very great. In hypothyroidism, though the uterus and ovaries may be normal, menstruation may be suppressed. The hyperthyroidism which attends normal menstruation and is apparent during pregnancy, though usually slight, is itself normal; its absence may be accompanied by evidences of toxæmia and psychic symptoms. Early arrest of growth and sexual precocity is in many cases associated with a persistent and enlarged thymus. In the rare cases in which the ovaries are rudimentary, or where from any cause they have been removed in childhood, the pelvis does not assume the female type, the breasts remain undeveloped, the legs are proportionately longer, hair grows upon the face, the distribution of the pubic hair is that of the male, and the mental characteristics are those of the male. In other words, the castrated female tends developmentally to assume the masculine type, just as the male castrated in early boyhood develops to a varying degree traits that are feminine.

The menopause, whether natural or brought about artificially by operative procedures, is frequently associated with the phenomena of endocrine dysfunction which precede, accompany, and follow the cessation of menstruation and comprise in the somatic domain disorders of the circulatory, respiratory and digestive systems, and in the psychic neurasthenia, psychasthenia and marked mental imbalance. Adjustments gradually take place with manifestations of lowered metabolism and increase of weight. The advent of puberty which in temperate climates occurs somewhere between the tenth and eighteenth, usually about the fourteenth year, and the cessation of menstruation, mostly between the fortieth and forty-eighth year, constitute epochs in the life of women. With sexual maturity the ovaries undergo sudden increase in size and acquire their definite form; following the menopause they undergo involution and become fibrous bodies of less than half their original size. During the long period of their functional activity these organs develop the rhythmical anatomical changes associated with the liberation of the ovum and the process of menstruation at regular periods of approximately twenty-eight days. This recurrence is normally interrupted by fecundation, pregnancy and lactation, and subject to derangement by various morbid states which act upon the functions of the ovaries by way of deranged endocrine influences.

iii. Corpus Luteum.

The rupture of the Graafian follicle and the expulsion of the ovum and epithelial cells surrounding it are followed by hemorrhage into the egg-sac which becomes converted into a corpus luteum. When impregna-

tion does not take place this small yellow body gradually suffers resorption and disappears. When pregnancy occurs the corpus luteum increases in size and forms an oval glandular mass which occupies a considerable portion of the cortex of the ovary and persists as an active endocrine gland for a period of more than two months. The ovaries furnish an internal secretion which has to do with the development of the sexual characteristics as puberty approaches, and from that period until the menopause they supply the Graafian follicles from which the corpora lutea successively arise. The functions of these glands are manifold. They apparently determine menstruation and limit the duration of its course; they arouse sexual impulses and desire. When fecundation occurs they directly or in association with correlated glands prepare the organism for the anatomico-physiological changes of pregnancy—the uterus for its growth, the placenta, the mammæ for lactation, the nervous system for new duties, the mind for new responsibilities. Whether the corpora lutea of pregnancy directly prevent the ripening of new Graafian follicles or this is brought about by hormones from the placenta or mammæ is uncertain. The cause of the usual subsidence of the nausea of pregnancy early in the third month is obscure; but the fact that this period approximately coincides with the involution of the corpora lutea is suggestive.

Pathological conditions of the most diverse nature act upon the ovaries and interfere with the normal performance of their functions. General, focal and pelvic infections affect them directly and also indirectly through primary action upon associated glands. Irregular, scanty or profuse menstruation, sterility, local and vague general pains, headaches and emotional disturbances result. These conditions constitute clear indications for endocrine therapy, which after careful study of individual cases should be promptly instituted. It is of the utmost importance that such combinations of the associated endocrine products should be made as are suggested by the symptom-complex; that the patient should have the benefit of such treatment as is required at the hands of the surgeon and appropriate specialists as early as practicable, and that all measures of personal hygiene should enter into the management of every case.

The ovarian products are prepared from the glands of the sow and are of three kinds—lutein from the corpus luteum—ovarian residue, that is the ovary remaining after the removal of the corpus luteum, and the whole ovary. These extracts are marketed in powder, tablets, capsules and as sterile solutions in ampoules. Each ampoule contains the purified and water-soluble extractive of two decigrams of dried substance of corpus luteum for intramuscular injection.

There is a wide difference of opinion among writers upon the subject as to the propriety of including the mammary glands, the placenta, the prostate, the mucosa of the duodenum, the spleen, the liver, the parotids, the lymph glands and the kidneys in the list of the endocrine organs and attempting to utilize extracts of these anatomical structures in treatment

While they show various more or less intimate physiological inter-relationships, it is far from clear that such attempts in the present state of knowledge have the warrant of a sufficient basis of fact.

Rowntree,¹ whose work in pharmacology and therapeutics, enables him to speak with authority, says of hormones or internal secretions, "The endocrine glands manufacture substances which act as catalysts and markedly affect metabolism. Under or overproduction of them results in the development of diseases of metabolism; thus, the absence of thyroxin leads to myxœdema; of the secretions of the pancreas (islands of Langerhans) to diabetes; of tethelin to infantilism; of the extract of the posterior lobe and pars intermedia of the pituitary to diabetes insipidus; of the parathyroids to tetany, and of some secretion of the adrenals to Addison's disease. On the other hand, excess of thyroxin leads to exophthalmic goitre and of tethelin to gigantism." And adds, "These secretions are chemical entities, one of them, thyroxin, having been synthetized and used therapeutically. Future therapy will probably use synthetic drugs to replace these internal secretions in the diseases of metabolism in which they are deficient." Meanwhile, as the brilliant results of thyroid feeding long antedated thyroxin, may it not be possible to now find further efficient remedies or combinations of remedies for endocrine dysfunction in preparations of the glands themselves, and supply them empirically, just as mercury and quinine were successfully used long before the treponema and plasmodium were discovered?

XVI.

TREATMENT OF DISEASES OF THE CIRCULATORY SYSTEM.

SAMUEL BRADBURY.

DISEASES OF THE HEART.

I. FUNCTIONAL AFFECTIONS.

THE functional affections of the heart, motor or sensory, may be symptomatic of early or of extensive cardiac disease, but for the most part they are but expressive of some general intoxication or nervous disorder. The electrocardiograph and other methods of investigation have greatly clarified our ideas concerning these conditions and further study will no doubt prove some of them to be due to various forms of organic disease.

When no organic basis may be discovered for these disorders, the treatment is in many respects similar and may be considered as a whole.

Treatment.—Of primary importance in the care of patients with apparent functional heart disease, is a careful examination and accurate diagnosis, to determine that there is no organic heart trouble responsible

¹Oxford Medicine, Vol. I, p. 886.

for the symptom complained of, and also the actual cause of the affection. This will make possible the first step in the treatment—full reassurance that there is no disease of the heart itself.

The wide range of possible causes for these complaints has been fully set forth in the section on diagnosis. They vary from the abuse of tobacco to the cracking of a highly strung nervous organism under the psychical and physical stress of war. For properly directed treatment the cause in the individual case must be accurately determined and corrected, and the patient must be taught how to live a correctly hygienic daily life.

Toxic Factors.—The immoderate use of tobacco, tea or coffee should be stopped. As a rule the complete interdiction of one or another of these toxic agents is less odious to the patient than any partial reduction plan. Substitutes are usually poor makeshifts.

CHRONIC FOCAL INFECTIONS tend to lower the general health level. They should be removed by surgical measures or free drainage provided. The chronic general infections, tuberculosis and syphilis, should be treated as has been advised in the respective chapters on these diseases.

ANÆMIA is as a rule but one symptom of the general condition from which the patient suffers. It should be treated with iron or arsenic or both.

STOMACH AND DIGESTIVE complaints appear often to be responsible. Whether functional or organic their relief is often followed by cessation of the heart symptoms.

MENTAL OVERSTRAIN AND WORRY are best relieved by a vacation, and, upon return to business, less close application and a daily period of exercise. The business man should take a walk of one-half to one mile each day on the way to or from work and an afternoon once weekly at golf is excellent. For the introspective type of individual some interesting occupation is far better than rest, and reassurance and explanation of the symptoms often does more good than any other measure. Many cases of irritable heart of soldiers, probably due to the psychical stress of the war, were cured rapidly by the Armistice.

GENERAL HYGIENE.—Meals should be taken at regular hours, eaten slowly, and not washed down with several glasses of water. The diet should be a normal one, eliminating only those foods that may disturb the digestion. The bowels should move daily, preferably by including in the diet fruits, vegetables, and coarse cereals, but failing thus, by a simple laxative. The patient should get at least eight hours sleep each night. The daily bath should be of cool or cold water depending upon whether or not the patient reacts well.

DRUGS.—In the nervous type of patient the treatment may well be started with the administration of sodium bromide 0.2 to 0.6 gram (3 to 10 grains) after each meal. Later many patients do better when taking tincture of nux vomica, 0.6 to 1.2 cc. (10 to 20 minims), or strychnine sulphate, 1 to 3 milligrams ($\frac{1}{60}$ to $\frac{1}{20}$ grain), before each meal.

Special Symptoms.—**Pain.**—Often an exceedingly puzzling symptom, pain over or apparently referred from the heart, may be of any degree, from

mild discomfort to the agonizing type known as angina pectoris. It is one of the early symptoms of failing heart but when this may not be demonstrated other factors must be searched for.

IMMEDIATE TREATMENT.—For the mild types of pain about the heart local heat may be all that is required. A dose of aromatic spirits of ammonia or of *spiritus aetheris compositus* (Hoffman's anodyne) is frequently effective. The patient is best when quiet.

For the severe types of cardiac pain the patient should be placed flat upon the back with the head low. Clothing about the neck and waist should be loosened but not otherwise disturbed. A hot water bottle or an electric pad may be placed over the cardiac area.

Amyl nitrite, 0.2 to 0.3 cc. (3 to 5 minims) in glass perles broken in a handkerchief, and the vapor inhaled is the drug of choice. Its action is evident immediately though it may not relieve the pain. *Nitroglycerine* (*glycerylis nitratis*) in tablets of 0.5 to 1 mg. ($\frac{1}{120}$ to $\frac{1}{60}$ grain), dissolved under the tongue may be used and is nearly as rapidly effective. Both drugs produce a vasodilatation and a resulting fall in blood pressure. For the therapeutic effect they should be given until there is a sense of fullness in the head or a mild headache. The action of both drugs is fleeting, their effects lasting not more than twenty minutes. In angina pectoris the action of these vasodilators is explained on the grounds that they relax spasm of the cardiac blood vessels and cause a fall in general blood pressure. Individuals subject to such attacks of severe cardiac pain may carry always one or the other of these drugs. The amyl nitrite comes in small glass capsules, the best type being that which is wrapped in cotton with a silk covering so that they may be crushed between the fingers and the vapor inhaled from the surrounding absorbent. Of nitroglycerine preparations the hypodermic tablets are best, but they deteriorate rapidly. The tube should be kept tightly corked and patients should be told to renew the tablets once each month.

If nitrites fail to relieve the pain immediately *morphine* should be given hypodermatically. A dose of 0.016 grain ($\frac{1}{4}$ grain) may be injected and the same dose repeated in an hour or less if pain is not relieved. In an occasional severe type of cardiac pain Osler advises the use of chloroform inhalations. When attacks are frequently repeated care must be taken that an opium habit is not formed.

Inciting factors for attacks of pain must be avoided. These are quite diverse and vary with each patient. They may be emotional or physical—even such mild exertion as stooping to lace the shoes. Sudden exertion appears more liable to cause them.

BASIC CAUSES.—Severe attacks of cardiac pain are seen most frequently in men who live under constant mental stress and whose lives are a succession of anxieties. They usually need a rest from business cares. Exercise must be advised only after a very careful study of the individual and history of the effect of exertion. It is rarely advisable to prescribe in any case more than the most moderate of exercise. After attacks of severe heart pain the patient should rest in bed for ten days or two weeks,

or longer if there are still any heart symptoms. Then he may be cautiously propped up in bed for several days and, if no recurrence of pain or signs of myocardial disease are present, he may be allowed very gradually to resume moderate activity.

Chronic conditions, such as gout, diabetes, and syphilis, affect the myocardium, and when heart pain is associated with these diseases it may disappear upon their adequate treatment.

Less severe pain is seen in individuals of excessively nervous temperament, or in those who have some chronic intoxication such as the excessive use of tobacco produces. Treatment must be directed at the cause.

When pain of any degree is an accompaniment of cardiac failure the proper treatment is rest and digitalis.

Syncope.—The patient should be laid flat upon the back with the head low. Clothing should be loosened about the neck and waist. The skin may be stimulated by rubbing and heat may be applied over the heart. The inhalation of ammonia (aqua ammonia) or of strong smelling salts is usually effective. When consciousness is regained the patient may be given a dose of aromatic spirits of ammonia. He should not be allowed to rise until color has returned to the face and lips. If the syncope be prolonged an injection of epinephrin, 0.3 to 1 cc. (5 to 15 minims), may be given and the patient treated as in a case of shock. External heat and raising the foot of the bed may assist in relieving cerebral anæmia.

Bradycardia or persistently slow pulse in the absence of any demonstrable cardiac disease requires no treatment.

Tachycardia without evidence of heart abnormality is symptomatic of some general affection to which treatment is directed.

Palpitation.—The patient must be first reassured as to the relative harmlessness of the condition. Often the stomach is distended and relief will be afforded by the administration of a carminative. To prevent recurrences of attacks, disorders of the digestive tract should be corrected and usually respond promptly to dietary regulation. Food known to cause flatulency must be avoided. Tobacco is best prohibited and occasionally tea or coffee may be the cause of such attacks. Underlying neuroses are best treated by such hygienic measures as have been described.

II. DISTURBANCES OF RHYTHM.

The special forms of arrhythmia are nearly always indicative of organic cardiac disease. A few forms in some instances appear to be due to toxic or nervous causes, but they are of little significance and require only the removal of the toxic cause.

Sinus Arrhythmia.—This is an affection of young people, usually seen when they are inactive, and it requires no treatment.

Extrasystoles.—Of themselves extrasystoles require no treatment but the probable cause which makes the heart muscle irritable must be searched for. In young individuals it is usually due to excess of one form or another—tobacco, mental work or worry, venery—and such cause should be

eliminated. In individuals over fifty years of age extrasystoles are usually due to myocardial disease, the approximate extent of which should be determined. If there is no symptom of heart failure, and the heart muscle is fully sufficient for current requirements, the patient should not limit his ordinary activities. He should however avoid unusual severe exertion. The attempt may be made, especially in persons who lead sedentary lives, to improve the muscular capacity of the heart by carefully graduated exercise. These exercises will also improve the nutrition of the heart by increasing its blood supply. The use of tobacco, alcohol, tea or coffee immoderately may increase an irritability of heart muscle in persons of this age, and their use should be stopped. Hypertension may be the cause. When excessive it is best reduced by rest in bed and the administration of small doses of chloral hydrate. Syphilis, if present, should be treated as advised in the section upon the treatment of syphilis.

Paroxysmal Tachycardia.—During the attack the patient should be quiet and allowed to assume the posture in which he is most comfortable. He may know of some special procedure, often quite bizarre, by which his attack may be stopped. A few of these may be tried in any patient—holding the breath, pressure upon the eyeball, putting the head between the knees, or the application of a tight abdominal binder. These procedures may be rapidly carried out and will do no harm if ineffectual. An ice-bag may be placed over the heart. With flatulency a dose of bicarbonate of soda alone or combined with a carminative may be effective in stopping the attack, its termination following the belching of a large amount of gas.

Drugs.—Attacks as a rule cease suddenly and spontaneously so that it is difficult to estimate the value of any drug. In long continued attacks digitalis may be administered, and should be given in full dosage. Bromides or small doses of chloral hydrate should be given to promote sleep during the regular sleeping hours.

In the intervals between attacks a search should be made for the cause of such attacks, and an attempt should be made to improve the general health. The digestive tract especially should be put into normal condition, and will usually respond quickly to regulation of the diet and bowels.

Auricular Fibrillation.—Many persons have auricular fibrillation but continue at their occupation without any complaint of cardiac trouble. The condition however always means that there is myocardial disease, and it is seen most frequently and characteristically in marked heart failure.

When general signs of heart failure are evident the treatment is that advised in the section (following) on the treatment of heart failure, irrespective of the irregularity of heart action, and, as a rule, without prospect of a return of normal rhythm. The occurrence of any pulse deficit probably calls for digitalis even if there are no other signs of heart failure.

In the absence of symptoms of failure the patient should be reassured as to his condition, and at the same time a definite course of life may be laid down. The amount of reserve heart function may be estimated by a simple exercise test, climbing one or two flights of stairs for instance, and

noting how long it may take the pulse rate and blood pressure to return to normal. This being determined the patient may be allowed work and exercise up to the limit of his cardiac capacity. The heart muscle will usually improve when the daily work it is allowed does not at any time exceed the capacity but does so exercise it that the nutrition is bettered. The patient should be searched for causes of myocardial deterioration, especially syphilis and chronic focal infection. The excessive use of tobacco may be responsible for part of the irritability and its use should be cut down.

Drugs.—During the last few years a number of reports have been made upon the action of quinidin for the correction of auricular fibrillation. In about 60 per cent. of the patients the normal cardiac rhythm is regained, and patients have been greatly benefited. The subject is so new that dosage and methods of administration have not been thoroughly worked out, nor is it understood in what manner the drug acts. There have been accidents reported from the use of quinidin. When the normal pulse has returned the electrocardiogram shows that the entire cardiac cycle is again normal.

The sulphate of quinidin is the drug usually chosen because of its easier solubility. Toxic symptoms are the same as those for any quinine salt—headache, ringing in the ears, and, with large doses, collapse, and occasionally hemianopsia. Its long continued use may produce anæmia.

The dose of quinidin sulphate usually administered is 0.4 gram (6 grains), and this may be repeated every four hours until the heart is regular or toxic symptoms appear. After the heart resumes its normal rhythm the drug is usually stopped. From the reported cases a few maintain the normal rhythm for long periods, most however relapse into fibrillation after periods varying from a few days to several months. The course may be then repeated, or if it be found that relapse occurs quickly after cessation of the drug, a dose of quinidin sulphate varying from 0.2 to 0.4 gram (3 to 6 grains) may be given daily or every other day depending upon the reaction of the individual. When normal rhythm is experienced for a month or two the condition of the patient usually greatly improves.

It should be clearly understood that the use of this drug is still in the experimental stage, that its action is by no means understood, and that its use is not without danger. Overdosage may cause fibrillation of the ventricles and death, or it may produce blindness. As the matter now stands quinidin holds great promise in these patients, and after a year or two of work carefully controlled by electrocardiograms and other methods we may hope to have another drug to assist in the effective treatment of heart disease.

Auricular Flutter.—This disturbance of cardiac rhythm is also usually a sign of myocardial disease. It can rarely be recognized without the electrocardiograph.

Treatment.—*Digitalis* should be given in full doses by the rapid method to blocking of the auriculo-ventricular impulse. In cases in which the ventricles respond to each auricular contraction and are running at a rate of 200 or more, *digitalis* should be given at once. After the auriculo-

ventricular bundle has been blocked, digitalis may be discontinued, and, as the block is relieved, the heart may resume its normal rhythm.

Heart Block.—Complete heart block without symptoms of cardiac failure needs no treatment except that which may be directed at a coincident syphilis, in the hope that a syphilitic lesion in the heart may be the factor responsible for the block.

Whenever block of any degree is associated with heart failure the usual treatment should be carried out—rest in bed, regulation of the diet, and the administration of digitalis. No further slowing occurs in cases of complete block but when the block is partial, digitalis should be given in small doses with the patient under close observation in order that the block may not be increased. The dose of digitalis should not exceed 1 cc. (15 minims) every six hours. The drug is continued until myocardial insufficiency is relieved or until toxic symptoms develop.

The syncopal attacks associated with block require the same treatment as is given in any other syncope.

Syphilis or chronic foci of infection may be responsible for heart block and they should be adequately treated.

III. ACUTE INFECTIOUS PROCESSES.

i. Pericarditis.

Acute pericarditis is usually a complication of one of the acute infectious diseases. It may however be the result of trauma, physical or climatic, or it may arise by the extension of a nearby suppurative process.

Treatment.—The patient should be put to bed and kept as quiet as possible to lessen the action of the heart. For the same reason, in the early stages, an ice-bag may be placed over the precordium either continuously or intermittently. Later some form of counterirritation may be more effective. Either mustard paste to reddening of the skin or small fly blisters may be used, and are said to assist in the absorption of the fluid. The diet should be nourishing but easily digestible.

For pain an opiate should be given. If the circulation is efficient stimulants should not be used. Digitalis may be necessary if the heart rate is very rapid or the pulse weak, and if there are signs of decompensation.

SPECIFIC MEDICATION.—For pericarditis developing during an attack of acute rheumatic fever the salicylates should be given in large doses as is advised in the treatment of rheumatic fever.

If pneumonia type I, or cerebrospinal fever, be the primary disease the appropriate antiserum should be given intravenously, or, if an effusion develop and it be tapped, the antiserum may be injected into the pericardial sac after aspiration of the fluid. The amount injected should not exceed the amount removed, and in any case should not exceed 60 cc.

Serofibrinous Pericarditis.—An exudate may collect in the pericardial sac and reach such proportions that it interferes with the action of the heart. When this occurs it should be aspirated.

PARACENTESIS PERICARDII.—The patient should lie flat upon his back if breathing permits, or he may be allowed to sit up against a firm back rest. The point of entrance for the needle depends upon the size of the pericardial sac. When very large the needle may be thrust between the 4th and 5th ribs just inside the left nipple. Another point of entrance, the one usually chosen, is in the fourth interspace not more than two centimeters to the left of the sternal border. When the effusion is large some prefer to insert the needle from the epigastrium, passing it close under the costal arch and directed upward, backward and slightly to the left. The sac should be drained of all fluid.

Empyema of the Pericardium.—In rare cases of acute pericarditis, or in cases in which the inflammation is due to the extension of an acute suppurative focus, the pericardium may contain frank pus. Aspiration drainage may be tried but is usually ineffective. It is best to institute free drainage by an opening through the chest wall between the fourth and fifth ribs close to the sternum.

ii. Acute Myocarditis.

Inflammation of the heart muscle practically always accompanies acute inflammatory processes in either the peri- or endocardium. Inflammation of the myocardium alone, sufficient to produce symptoms, is unusual, even as a complication of the acute infectious diseases. A certain degree of myocardial degeneration probably occurs in every case of severe infectious disease, and when severe, is accountable for the instances of sudden death during the later stages and in the convalescence of these patients.

Treatment.—The essential part of the treatment is the avoidance of every possible strain upon the damaged heart muscle. The patient should be confined to bed and not allowed to make any movement which is not absolutely necessary. This should be continued for some days after the heart sounds and quality of the pulse have resumed their normal rate and strength.

Extremely rapid heart action is often a troublesome symptom. The ice-bag may be applied to the precordial area either continuously or intermittently; it appears to have a slowing effect on the heart, and it will relieve moderate pain.

The food should be nourishing and easily assimilable. The amount of fluid ingested should be limited to 1200 cubic centimeters (1 quart) for the adult, and proportionately less for children. A large amount of the fluid may be milk, and if the stomach is retentive, lactose and cream may be added. Protein should be strictly limited as it directly increases the work of the heart.

The bowels should move daily and it should be ascertained that this is accomplished without straining. An effective laxative must be given if necessary.

Drugs.—For pain which is not relieved by the ice-bag, codeine or morphine should be administered. These drugs are also useful in quieting restlessness when small doses of bromides or chloral hydrate are ineffective.

Digitalis may be given when stimulation is urgently indicated. Otherwise it is best to relieve the circulation by complete rest and thus allow the acutely inflamed heart muscle all the rest it can get. In urgent cases caffeine by mouth or hypodermic may be given. When there is marked œdema theobromine sodium salicylate or theocin may be given for their diuretic effect.

CONVALESCENCE should be prolonged; great care should be taken that the patient is not allowed out of bed too soon, nor allowed to go about his usual activities before the heart muscle has fully recovered. The time in bed varies for the individual, depending upon the force and rate of the pulse and the heart sounds. Usually in ten days or two weeks after the fever has disappeared and the pulse is of normal strength the patient may be cautiously propped up in bed, and if this does not increase the pulse unduly, about a week later he may be allowed to sit in a chair for a short time each day. From this time on the patient should very gradually increase his activities, always being careful that the pulse rate is not greatly increased, and that it returns to normal within a few minutes after exertion.

iii. Acute Endocarditis.

Acute inflammation of the endocardium usually appears as a complication of one of the acute infectious diseases, and is especially frequent in acute rheumatic fever. There is no way by which it may be prevented.

Treatment.—Most important at the onset and throughout the acute stages of the disease is rest. The patient should be confined to bed, supine if the breathing permits, propped in the sitting position if there is marked dyspnœa. He should be allowed no exertion and mental quiet should also be insisted upon. No unnecessary visitors should be allowed to see the patient.

General Management.—*The diet* should be nourishing but easily digestible. Milk and eggs in some one of their various preparations should supply the bulk of the caloric intake. Toast, butter, fruit juices, and sugar, may be allowed during the stage of fever and after its decline starchy vegetables and simple desserts may be allowed.

Water ingestion should be carefully watched; as a rule the patient should take it in increased amounts as for any acute infectious process.

The bowels should move daily and the bed pan must be used. Care should be taken that this function be made as free from exertion as possible. Enemas are often exhausting to bed patients and a mild laxative, such as cascara or phenolphthalein is usually best. In some cases sodium phosphate or Rochelle salt is more satisfactory.

Fever.—Fever is as a rule irregular and does not require much treatment. Sponges of warm or cool water may be used and serve at least to make the patient more comfortable.

The skin should be cleansed twice daily, especially in those patients who have much sweating.

Locally.—A lightly filled ice-cap to the precordial area is useful. It appears to quiet the heart action and will usually relieve mild pain.

Drugs.—There is no specific remedy for the treatment of acute endocarditis.

Sodium salicylate may be tried in those cases in which the heart infection has occurred with acute rheumatic fever, but it has been shown that this drug does not play any part in preventing valvular infections, and it is probably of no use in treating them.

The iodides have been highly recommended by the French. The dosage given is small and should be continued for weeks. Potassium iodide, or the syrup of the iodide of iron may be used.

In cases of malignant endocarditis, when a blood culture has definitely determined that the infecting organism is pneumococcus type I, or meningococcus, the specific antiserum should be used in large doses intravenously. Nearly all such cases die in any event and no harm will be done if desensitization to horse serum is properly carried out.

Stimulation.—It is desirable to keep the heart as quiet as possible. *Digitalis* does not control the pulse rate in these cases and it should be used only for extreme weakness.

Restlessness.—Sodium bromide or chloral hydrate should be tried first. If they are ineffective small doses of codeine or of morphine should be administered.

Subacute infectious endocarditis is treated in the same way as the acute process. There may be slight continuous fever of 99 to 100° F. for weeks or months with the occasional occurrence of crops of petechial spots. The patient must be kept in bed during the fever and should return to bed on its recurrence.

Frequently in these cases chronic collections of pus are found which appear to be the cause of the continued infection. They should be eliminated by thorough surgical measures.

CONVALESCENCE.—The rest in bed should be continued for long periods in order that the damaged heart valves may recover all functional power. It should be of at least two months duration and patients who have made a good functional recovery have been kept in bed for three months or more, even if all acute signs and all fever have disappeared. When the patient begins to go about the room after a carefully guarded convalescence, a better estimate may be made of the valvular damage and future exertion may be then limited accordingly.

iv. Chronic Cardiac Disease.

In chronic diseases of the heart symptoms are produced by a failure of the heart muscle to properly meet its duties. It matters little whether there be chronic valvular disease, chronic myocarditis, an adherent peri-

cardium, or hypertrophy and dilatation from long standing hypertension, the cause of the failure is a heart muscle which is itself weakened or which must overcome burdens too great for its capacity. For this reason the treatment of these affections is grouped, as it better serves to emphasize the point at which treatment is directed, either by lessening the heart's work or by improving the strength of muscular contraction.

The physician may, in appropriate cases, initiate procedures which are designed to postpone heart failure, he may begin treatment during its early stages, or he may not be called upon until the failing heart has put the patient to bed with a well developed clinical picture. In each case the effort should be made not only to relieve symptoms, but, by advice upon the mode of life, he should endeavor to so improve the condition of the heart muscle that the patient may live in comfort.

The discovery of a valvular or other heart lesion should not mean the immediate prescription of rest in bed and digitalis; it should call for a careful examination and estimation of the heart power in that individual. The patient may then be intelligently advised as to what he may or may not do. In order that his full coöperation be obtained, it seems best, when a definite organic lesion is found, that he be told of it and of its care. He should understand the ill effects of constant overstrain, should be taught to recognize the symptoms which mean "stop," and should learn for himself the procedures, whether they are drugs, diet, or rest, which best suit him.

In all cases the quality of the heart muscle is the important factor in recovery and continued comfort. Early, it may be trained to overcome some of its deficiencies just as skeletal muscles are trained for special work. In some late cases it is so deteriorated that there is no procedure which will improve its working capacity.

(a) POSTPONEMENT OF FAILURE.

The normal heart has a large reserve of power to provide for unusual physical exertion. Individuals with an organic lesion have a lessened or no reserve power. When they are without signs of heart failure under ordinary conditions, there is still an efficient circulation and a reserve, usually less than normal, upon which they draw for extra exertion. In a few cases of organic heart lesion no loss of heart efficiency may be demonstrated except under the most violent exertion, but in most cases it is plainly evident even in the usual round of daily duties. Climbing several flights of stairs, or running for a car causes dyspnœa or palpitation which may last for an hour or more, or there may be substernal pain or excessive exhaustion.

In these early cases the individual must be taught to live always within his reserve, and to take care that no further cardiac damage be done. The occupation, mode of life, and the prevention and cure of infections are the important points in the regulation of his life.

Occupation.—The patient with a cardiac lesion should not be engaged in any work which requires such physical effort as will bring on dyspnœa, pain or palpitation. Young persons may be more readily adjusted in

this respect, but older men with the responsibilities of a family often find it difficult to seek a new niche. The result of constant overstrain should be pointed out however and the effort be made to change to a suitable occupation.

Living Quarters.—In cities where many families live in homes which are reached only by a climb of two to five flights of stairs the question as to living quarters, and the effect of the climb to them should always be inquired into. If there are dyspnoea and palpitation which last for a half hour or more after such exertion, or if the patient must rest at each flight in order to get up at all, he should move to a home which is nearer the street level.

Exercises.—Physical exertion which does not cause symptoms of cardiac distress is beneficial. The blood supply, and therefore the nutrition of the heart muscle is improved, and by careful upward gradation the cardiac function may be improved. In nearly every case of heart damage the violent games, such as tennis, football and handball, and the sports which require long continued strain, such as rowing, should be avoided. For middle aged persons especially, golf, walking, and light gymnastics are the best forms of exercise. No exercise should be carried to the point of exhaustion, nor should it cause pain or dyspnoea of some duration.

Diet.—Food should be well prepared and plain. Care should be taken that the stomach is not overladen at any one meal. It is best to have a light evening meal, and most of the nourishment taken for breakfast and lunch. Water need not be limited except that large amounts should not be taken at meal times.

BOWELS.—The bowels should move daily. This is best regulated by an adjustment of the diet, including fruits and green vegetable. Mineral oil or agar may be tried, but these failing a mild laxative should be given each evening.

OVERWEIGHT.—Obese individuals are much improved by a reduction of weight. It should be slowly carried out first by elimination from the diet of sugar and part of the starchy vegetables and bread. Except in extreme cases one pound a week is as rapid a reduction in weight as is desirable. Most persons feel better when slightly under normal weight and the cardiac is no exception.

In those patients in whom the cardiac deficiency appears due only to a fatty heart the reduction of weight is the most important part of the treatment.

TOBACCO.—Young individuals are better if they abstain from tobacco, as smoking to excess is a habit easily acquired. Older men who have used tobacco all their lives may be allowed 2 or 3 mild cigars each day. Tobacco in any form usually causes overaction of the heart, renders the muscle irritable and may cause extrasystoles.

BATHING.—Hot baths, over 104° F., should not be taken. They raise blood pressure and pulse rate. If the patient reacts well a cold sponge or short shower may be taken each morning. Rough sea bathing and swimming are best avoided.

Climate and Altitude.—Temperate climates are best—very hot weather is depressing, and in cold climates mild respiratory infections are frequent.

Suitable altitudes vary with the individual patient. As a rule persons with cardiac disease do better at moderately low altitudes, not over 1200 feet. In most high altitudes there is another factor to be considered—the frequent grades which are often steeper than it is wise for persons with limited cardiac power to attempt.

The question of altitude may be important in advising a change of climate. In the journey across the United States, for instance, the passage of the Rocky Mountains carries trains to considerable altitudes. At one point the Union Pacific Railroad attains an elevation of nearly 8000 feet, while the lowest maximum elevation on any line, the Canadian Northern, is 3650 feet.

CHILD BEARING.—It may be necessary to decide whether or not a woman with cardiac disease should undertake to bear a child. The young woman without pelvic abnormalities and a good or moderate reserve heart power may undertake pregnancy. The woman who easily shows symptoms of distress on exertion, and most women of 35 years or more, especially if it be the first pregnancy, should avoid child bearing.

INFECTIONS.—In any patient with heart disease a latent syphilis or a chronic focus of pus should be searched for and when found appropriately treated.

The mild acute respiratory infections should be avoided, and, if contracted, they should be carefully cared for.

Drugs.—There is little place for drugs in the care of patients of this class. Babcock says “Good advice is paramount to prescriptions.” The patient has a crippled heart; he must learn to get along with it and not abuse its limitations.

A few of these patients may be anæmic and will be considerably improved if the blood can be brought up to normal. Iron is the best drug for this purpose.

Hypertension.—The patient with an hypertrophy of the heart following a long continued hypertension is very properly a subject for care in the prevention of heart failure. When it may be found the cause of the hypertension must be treated as is advised in the appropriate sections. The patient must understand that the heart is working against increased resistance and that he should be sparing in increasing the strain. The use of drugs, such as the nitrites, is of no value to these patients.

(b) ACUTE HEART FAILURE.

Acute heart failure is somewhat unusual but it does occur and sometimes without apparent cause. There is usually marked dilatation, urgent dyspnoea, cyanosis, great restlessness and a rapid feeble often irregular pulse.

Treatment.—To quiet the patient is the first necessity, and to assure this a hypodermic injection of morphine sulphate is best. The patient should be recumbent with the head and shoulders raised.

In these cases, more than in any other heart condition, venesection is indicated, and as much as 500 to 700 cc. (16 to 20 ounces) of blood may be abstracted.

Drugs.—Strophanthin is the most rapidly effective drug. It should be given intravenously in the dose of 0.5 mg. ($\frac{1}{120}$ grain), and this dose may be repeated in an hour if necessary. When strophanthin is not available tincture of digitalis should be given by mouth in full doses.

Camphor 0.13 gram (2 grains) in oil, ether 4 cc. (1 dram), or strychnine sulphate 2 mg. ($\frac{1}{30}$ grain) may be injected hypodermatically.

(c) EARLY HEART FAILURE (DECOMPENSATION).

While the division of cases into early and advanced failure is somewhat artificial it is true that there are many patients who present symptoms of slight decompensation whose treatment differs radically in several respects from those patients who are confined to bed from their heart disability. They may have but slight œdema of the feet at night, or they may be comfortable and without symptoms when quiet, but dyspnœa, tachycardia, or pain are induced by slight exertion. Many of these patients may be treated as ambulatory cases, though probably all are better in bed for a few days when treatment is started, while the case of advanced failure must be at absolute rest and usually has radical changes made in his diet and fluid intake.

Treatment.—Depending somewhat upon the degree of symptoms a few days rest in bed is desirable in beginning the treatment of early heart failure. It is by no means necessary in all cases as the large numbers of these patients who are treated in dispensaries can bear witness, but recovery is more prompt when rest may be taken.

Drugs.—Digitalis is the only drug worth consideration in the treatment of these patients. Other drugs with similar properties, such as squill, convallaria and strophanthus are variable in activity either due to poor absorption from the intestinal tract or to uncertain strength of their preparations. The physician best accustoms himself to the use of digitalis, using always a preparation which has been physiologically assayed for activity and standardized.

The usual methods of assay are the "frog method" of the United States Pharmacopœia, and the "cat method" of Hatcher. The Pharmacopœia requires that digitalis be of such activity that the minimum lethal dose be equivalent to 0.6 mg. of digitalis leaves for each gram of the frog tested, the drug, in solution, being injected into the anterior lymph sac. In assay by the "cat method" the drug is injected slowly and continuously into a vein, the "cat unit" being the weight of the dry drug in mg. which is required to kill one kg. of cat. The average good tincture is approximately of the strength of one cat unit per cc. (15 minims).

Digitalis, in therapeutic doses, slows the heart by vagus stimulation, increases the force of ventricular contraction by direct action upon the heart muscle, and depresses conductivity in the heart. This latter action is the

most noticeable one and is best seen in auricular fibrillation when there is a large pulse deficit. Under the action of digitalis the feeble ineffective beats of the ventricle gradually disappear until ventricle rate and pulse rate are the same. This action is due to the blocking of many of the auricular impulses in the auriculo-ventricular bundle. The action upon the blood pressure is variable but in general digitalis tends to bring the blood pressure to the normal for the individual. A high blood pressure is no contraindication to the use of digitalis. Nausea and vomiting produced by digitalis are due to its action upon the central nervous system and this effect may not be avoided by other methods of administration than oral. A few patients may seriously object to the taste of the drug in solution but in most of these cases the difficulty may be overcome by giving the powdered leaf in gelatin capsules.

Of the official preparations, the tincture or the powdered leaf are the best. The infusion cannot be depended upon for constant activity even if it be made from the same bottle of leaves. Both leaves and tincture maintain their strength fairly well. The leaf has the advantage of being administered in gelatin capsule, while the dose of the tincture may be so easily varied. The tincture should always be measured by pipette or graduate, never by "drops," as there may be anywhere from 30 to 40 drops of tincture of digitalis to each cc. (15 minims).

The numerous proprietary preparations of digitalis have no advantage for oral administration, over a good official preparation of the leaf or tincture. For hypodermic use the best of the digitalis group preparations are either amorphous or crystalline strophanthin, but its administration should be reserved for emergencies only.

Digitalis is administered until there is improvement in the clinical symptoms, or until signs of digitalis intoxication occur. The latter are slowing of the heart rate to sixty per minute or less, nausea or vomiting, premature contractions or extrasystoles, a coupled rhythm, and partial or complete heart block. In a few patients a mental depression, perhaps the earliest sign of nausea, may be the first symptom of minor toxic action noticed.

Dosage of Digitalis in Early Failure.—To the individual with early failure digitalis is given in relatively small doses. One to 2.5 cc. (15 to 40 minims) of the tincture, or 0.1 to 0.25 gram ($1\frac{1}{2}$ to 4 grains) of the powdered leaf, are given three times daily until there is clinical improvement or symptoms of toxic action occur. Using the larger dose for persons of the usual size (150 pounds), these symptoms may be expected in about five days, but usually the clinical improvement has been so marked previous to this time that the dose may be reduced or the drug discontinued. If toxic symptoms develop it is best to stop the administration of digitalis for 24 to 48 hours, and then, if it still is necessary, to give one daily dose of the tincture 0.6 to 1.5 cc. (10 to 25 minims), or of the powdered leaf 0.06 to 0.15 gram (1 to 2 grains). Some patients may, with benefit, take digitalis for weeks, and for these cases the dose must be carefully graded for each individual

as it will be found to vary considerably, depending upon how much is excreted each day. This has been found to be, on the average, about 1.3 cc. (20 minims) of the tincture, but it may vary from 0.6 to 1.5 cc. (10 to 25 minims). When such continuous administration is necessary the patient should be taught to control his own dosage and be given a thorough understanding of the action and toxic signs of the drug.

As the patient recovers the possible cause of the heart lesion should be searched for. Patients with syphilis should be adequately treated with small doses of an arsphenamin preparation and long courses of mercury and iodides. Foci of infection should be surgically eradicated whenever possible. These factors may not have been responsible for the primary lesion but they may cause further damage and their proper treatment will often clear up the heart difficulty. The patients with hypertension and cardiac hypertrophy and dilatation require for their continued well-being, search for and treatment of the cause of the high blood pressure.

General Management.—As in efforts to postpone heart failure, the occupation, mode of life and residence must be adjusted to the heart capacity of the individual. What was said in the previous section with regard to work, exercise, tobacco, alcohol and overweight applies to these patients with doubled emphasis.

DIET.—The food intake as a rule should be strictly supervised. It should be nourishing, easily digestible, and should include all classes of foods. Articles which are known to cause flatulency must be avoided. At times it is best to limit the salt intake, especially in the patients with hypertension or with slight cedema.

As a rule the fluid intake need not be changed, though occasionally the patient is encountered who takes an amount which is too much for the circulation to handle. Six glasses of water and perhaps one cup each of tea and coffee, about 1600 cc., should be a sufficient daily allowance. The intake may be increased in hot weather to allow for increased activity of the skin.

BATHS.—The usefulness of baths, either plain or with carbonic acid gas, apparently depends upon gentle exercise of the heart muscle by the changes which they occasion in the circulation. They appear especially useful in the patients who exhibit mild symptoms of heart failure. Osler observed the results in a number of persons treated at Nauheim, and groups the results into three classes—first those who had no heart trouble and were benefited by the change and holiday; second, neurotic individuals and patients with advanced heart failure, neither of which class did well, and lastly “Chronic myocardial cases, fat patients with weak hearts, and the cases of valvular disease with slight disturbances of compensation but not with dropsy.” In these cases good results were obtained.

According to Holst the chief effect of the bath is due to the temperature of the water. At the “indifferent” temperature, 33 to 35° C. (91.4 to 95° F.) there is very little or no effect upon the heart work. Below this temperature cool baths cause an increase in blood pressure and a decrease in pulse rate. Warm baths, above the indifferent temperature and up to 40° C. (104° F.)

cause a rise then a fall and then a second rise of blood pressure. The pulse rate falls if the temperature is below 37° C., rises if above that degree. Hot baths, above 40° C. (104° F.), cause an increase in blood pressure and pulse rate, and a rise in body temperature.

The indifferent and cool baths are those used in the treatment of heart disease. At first a plain bath of indifferent temperature is given, and then baths of reduced temperature with increasing amounts of salt and carbonic acid. At Nauheim the usual course is about one month, 4 to 6 baths being given each week. All bath treatment for patients with heart disease should be under the control of experienced physicians. Physicians who have tried them for their patients at home and who have observed the effect of the baths as given at a resort acknowledge that the best results are obtained by sending the patient to a spa.

EXERCISE.—The reason for exercise in the cardiac patient is the same as that for the athlete—training of muscle—in the athlete of the skeletal muscle principally, in the cardiac, of the heart muscle. Barringer says that the end to be achieved in exercising a damaged heart is to so grade the work that the heart muscle is stimulated to contract more energetically, thereby increasing the output of blood per beat, and at the same time increasing the supply to the heart itself, and to avoid any duration or degree of exercise which would fatigue the heart and interfere with its nutrition.

In exercise for the cardiac, to start with, it is necessary that there be a reserve of muscle power over the demands which the heart must meet. Exercises cannot be undertaken in cases of advanced failure, and in any case they must be carefully graded to the heart of the individual in question. The patient with early failure is especially suitable for exercise after he has recovered sufficiently by rest or drugs to have developed a reserve of power over his current needs. But even in cases of advanced failure whose hearts are again compensating, it is surprising what may be done. A few of these patients under skilful supervision may have many years of useful activity.

The value of exercise to the cardiac is explained on the bases that:

1. When skeletal muscles are worked more oxygen is required. This is supplied by an increase of blood flow and a dilatation of the capillaries of the working muscle.

2. The call for an increase of blood flow is met by a more forcible contraction of the heart and the blood pressure is raised.

3. The rise in blood pressure is general and forces blood through all the body arteries at a higher pressure. This includes the coronary arteries, and the increased blood supply more efficiently nourishes the heart muscle.

4. When enough skeletal muscles may be worked there is a great increase of blood in the periphery lessening the stagnation of blood in the great vessels near the heart.

5. Johannsen has shown that the products of muscle metabolism are stimulants to the heart and to the respiration.

Contraindications.—Patients with signs of advanced failure such as cyanosis, dyspnoea, enlarged liver, oedema and pain, and those with aneurism, marked arteriosclerosis, and those with pericarditis, endocarditis and myocarditis following the acute infections should not be exercised. No cardiac should be exercised who has fever of any degree.

To determine, in doubtful cases, if exercises be desirable, and in any case the amount of exercise allowable, the symptomatic tests of dyspnoea, exhaustion, pain, cyanosis and tachycardia are used, and the blood pressure, curve and pulse rate are observed. As a general rule it is unwise to exercise patients who are subject to attacks of cardiac pain.

General Rules for Exercise.—In cardiac patients, especially at the start, exercise should be under the careful supervision of a physician or attendant trained to this work. For the first few days it should be well within the capacity of the heart; it must be in periods of short duration, for some cases not longer than forty seconds. Each exercise period should be followed by a rest until blood pressure and pulse rate are again at the usual rate for the individual. The rise in blood pressure should be rapid after the beginning of exercise and it should fall quickly after exercise has stopped. If the rise is late or increases after exercise has stopped the amount of work is too great. The pulse rate likewise should rise and fall rapidly, though Barringer has not found the estimation of the pulse rate of as much assistance in gauging heart work.

Types of Exercise.—Exercise has been classified as energetic and mild depending upon the response noted in the blood pressure (Barringer), the mild types causing a rise of 5 to 10 points and the energetic causing rises of 20 to 40 millimeters of mercury. As a rule the mild exercise is continued over longer periods, and its best type is walking on a level surface. The energetic form may be the use of dumb bells of 1 to 3 pounds weight, or it may be the resisted movements such as those of Schott. The use of dumb bells allows a more accurate amount of work, and, as patients improve on mild forms of exercise the use of dumb bells may be added.

Mild exercise may also be graded by increasing the distances travelled and by adding short grades as is done in Oertel's "terrain cure." When patients have improved to this extent, that they may take short grades without symptoms, they may be allowed to indulge in the milder outdoor occupations and in golf. Gardening is excellent for these individuals. Golf should be in short periods, and care should be taken that the course is not too hilly.

The value of exercise in assisting in the reduction of overweight can scarcely be overestimated, especially for the individual with obesity and a weak heart. Most persons feel better when a few pounds under the normal weight for their height and age, and cardiacs are no exception to this rule.

(d) ADVANCED FAILURE.

The heart in advanced failure is laboring under burdens far exceeding its power. The patient is usually of necessity quiet as the slightest exertion accentuates his constant discomfort.

Treatment.—Rest.—Absolute mental and physical rest is the first requisite in the treatment of these patients. Bed is preferable but in some severe cases may not be possible. The head and shoulders must be elevated and some patients insist on spending most of the time in a chair, even for sleeping at night. Not infrequently the patient may be more comfortable if leaning forward with the head resting on the folded arms propped on a chair-back in front of him.

MENTAL REST is no less important than physical. The patient must not be annoyed by numerous visits from friends and every effort must be made to keep from patients the petty annoyances and cares of daily life.

Both mental and physical rest may be assured for the first few days of treatment at least, by the hypodermic administration of morphine or of codeine. When dyspnoea and restlessness are moderate a small dose may be used, morphine sulphate, 0.008 gram ($\frac{1}{8}$ grain), or codeine phosphate, 0.016 gram ($\frac{1}{4}$ grain), for adults, but for the orthopnoea and severe distress seen when cases of severe cardiac disease are admitted to hospitals, it is best to give the full dose of morphine for the adult at once, and, if necessary, to repeat this in two hours. As the more marked symptoms subside under treatment of the first few days, bromides may be given in small doses three times daily, or if the patient be sleepless chloral hydrate or paraldehyde may be given in a single dose at night.

As the dyspnoea and oedema are relieved the patient may gradually assume the supine position, and he should be kept flat in bed for ten to fourteen days after all symptoms of failure have disappeared.

THE BOWELS should move daily. In the early stages, when there is much oedema, a saline cathartic in sufficient dose to produce one or two watery stools should be administered. This will aid in the elimination of fluids and will prevent much straining at stool. In many of these patients it may be best to allow them the use of the commode at the bedside rather than insist that they use a bed pan. Later, when oedema is subsiding, the dose of cathartic may be reduced, or one of the vegetable laxatives may be administered.

An ice-bag to the precordial area is often useful when the action of the heart is very turbulent, and appears to quiet it and slow the number of contractions.

Diet.—In patients with advanced failure the diet must be regulated with regard to both quality and amount, and fluids must usually be restricted.

The stomach is often extremely congested and functions poorly, and for this reason, especially during the earlier days of treatment, only the most easily digestible food is desirable. Many patients do better, for the first twenty-four hours at least, on small amounts of water only. What food is taken should be nourishing, it should not cause flatulence, and the protein should be restricted because it increases metabolism and therefore directly increases the work of the heart.

On beginning treatment, milk or one of its preparations, such as buttermilk or junket, is best. It may be given hot or cold, should be slowly

sipped, and taken not oftener than once every 4 or 5 hours. The *Karrell cure* is excellent as it limits both liquids and salt. "Two hundred cubic centimeters (7 ounces) of skim milk sipped slowly at 8, 12, 4 and 8 o'clock, and no other liquid or solid during the day or night for four to seven consecutive days is not a severe ordeal and shortens convalescence materially." (Potter.)

As acute symptoms of heart failure subside, and the patient desires it, with each glass of milk he may be allowed first a slice of dry toast, bread or a cracker, then one or two eggs during the day, mashed potato, vegetables and finally a normal simple diet may be resumed. When this time arrives the patient may, to a great degree, select his own diet only avoiding food which will cause flatulence or may upset the digestion. Protein may now be taken provided its limitation is not indicated by kidney or vascular disease.

The question of salt intake is of especial interest in œdema and will be discussed under the treatment of that complication.

FLUIDS.—When symptoms of heart failure are acute and there is much œdema, fluids must be restricted. The amount taken daily in the *Karrell cure* is an excellent method of limiting them early in the treatment. Later, as the food intake is slowly increased, it is best to limit fluid to 1000 cc., and, even after all symptoms have disappeared, it is wise to allow no more than 1500 cc. of fluid (water, milk, tea, coffee, soup, etc.) each day. There is but one possible exception to this rule—the patient with kidney disease and inability to concentrate—to whom it is rarely necessary to give more than 1800 cc. of fluid daily.

Drugs.—For the patient with advanced failure the administration of digitalis by the large dose method is especially suitable at the start. The first effects of such large doses may be seen in electrocardiographic records within two hours, and, if there is a fairly good myocardium, the patient is considerably relieved within twenty-four hours. The best results of the action of digitalis are obtained when the patient is not far short of such saturation with the drug that minor symptoms of intoxication occur. The amount of digitalis which will produce toxic symptoms, in the average patient, bears a close relation to the usual body weight, not the weight of the œdematous patient, and *provided no digitalis has been taken within the preceding two weeks.*

Several methods may be used to calculate this amount. The simplest way to estimate the dose of the tincture, is to multiply two minims (0.13 cc.) by the weight of the patient in pounds, giving, for a man of 150 pounds, a *total dose* of 5 drams (20 cc.). Pardee advises that this amount be administered within three days, one half of the total amount, or 10 cc. (2½ drams) of the tincture on the first day, and that the remaining one-half of the total dose be divided into eight equal amounts one of which is administered every four hours beginning on the second day. The tincture is 10 per cent. strength, therefore the dose of powdered digitalis is one-tenth of the calculated amount of the tincture, or for the same weight man, 2 grams (½ dram).

Complicated but more exact is the "Body Weight Method" described by Eggleston. He used digitalis preparations the activity of which had

been determined by the Hatcher "cat method," and found that for oral administration in man the average total dose of digitalis was equal to 0.15 of one cat unit per pound of body weight. Upon this basis he has constructed formulas for the calculation of the total dose of the tincture and of the powdered leaf. In these formulas following, "C. U." represents the milligrams of digitalis in one cat unit, and "W," is the weight of the patient in pounds.

Formula I $\frac{\text{C.U.} \times 0.15 \times \text{W}}{1000}$ =grams of powdered leaf in the total dose.

Formula II $\frac{\text{C. U.} \times 0.15 \times \text{W}}{100}$ =centimeters of tincture in the total dose.

Preparations of digitalis with an exactly determined cat unit are not readily available, but Eggleston states that using good preparations from a reliable manufacturer the cat unit may be considered as 100 mg. of the dry drug. This would mean 0.1 gram ($1\frac{1}{2}$ grains) of the powdered leaf or 1 cc. (15 minims) of the tincture of digitalis. He further states that when such unknown preparations are used the total dose administered should be considered as but 75 per cent. of the calculated dose. Using formula I, 100 milligrams (the cat unit) multiplied by 0.15 equals 15; 15 multiplied by 150 (pounds) equals 2250; 2250 divided by 1000 equals 2.25 grams, and 75 per cent. of this equals 1.6 grams (24 grains). This amount would be the total dose of powdered digitalis which would be required to digitalize a 150 pound patient. Using formula II, 100 milligrams multiplied by 0.15 equals 15; 15 multiplied by 150 equals 2250; 2250 divided by 100 equals 22.50 cc., and 75 per cent. of this amount equals 16.8 cc. which would be the total dose of tincture of digitalis for a 150 pound patient.

Administration by the Eggleston Method.—When no digitalis has been taken during ten days preceding, and as there are individuals who are more susceptible to the action of digitalis than the average person, the total calculated dose is not given at once. In patients with severe symptoms one-third to one-half of the total amount is given at the first dose, six hours later one-fifth to one-fourth of the total is administered, and after a second six hours interval one-eighth to one-sixth is given. If then, after six hours more digitalis is required, and there are no toxic symptoms, about one-tenth of the total calculated dose is given every six hours.

When symptoms are not so urgent the initial dose may be smaller, about one-fourth of the total being given at once and the same amount again in six hours. Thereafter one-tenth of the total dose may be given every six hours.

If digitalis has been taken within the preceding ten days not more than one-half the total calculated amount should be given rapidly. This one-half may be divided into three or four doses, depending upon the urgency of the case, and one dose given every six hours. Then if necessary the administration of digitalis may be continued in amounts of one-tenth the calcu-

lated total until digitalization is complete. In all of the above dosage the six hour interval is selected because it has been found that the absorption of a single dose of digitalis is complete in six hours.

At the risk of repetition the signs of minor digitalis intoxication are again given, as their appearance should mean the cessation of digitalis therapy. Earliest are usually nausea and vomiting, later slowing of the heart rate to sixty or below, the occurrence of frequent premature contractions (extrasystoles), of coupled rhythm, or of heart block.

The methods of large dose administration of digitalis are especially valuable in rapidly controlling the heart action in severe heart failure, and the employment of one or another method will often obviate the necessity of hypodermic or intravenous medication.

INTRAVENOUS MEDICATION.—In an unusual acute emergency it may be necessary to use a drug of the digitalis group by intramuscular or intravenous injection. Of late there has been an occasional fatality which was the apparent result of the use of one of these drugs, especially strophanthin. Nevertheless there is the rare case in which it appears that relief must be immediate, and for these patients strophanthin is invaluable. Before its administration it must be carefully determined if the patient has had any digitalis within the preceding ten days or two weeks, and if so, if there are any signs of its action remaining. If there are signs of persisting action the intravenous administration of a drug such as strophanthin in full doses is dangerous.

The best drugs for intravenous administration are amorphous strophanthin (strophanthinum U. S. P.), and crystalline strophanthin-G of Thom, or ouabain. Ouabain is more active than amorphous strophanthin.

Strophanthin (amorphous) is easily soluble in water or in physiological saline solution; it may be purchased in tablets for hypodermic use or in ampoules in solution. The tablet form is preferable as the drug then keeps indefinitely. The dose given is 0.3 to 1.0 mg. ($\frac{1}{200}$ to $\frac{1}{60}$ grain). If no digitalis has been administered within ten days past, the initial dose may be 0.5 to 1 mg. ($\frac{1}{125}$ to $\frac{1}{60}$ grain), but if digitalis has been administered within ten days the initial dose should not exceed 0.5 mg. ($\frac{1}{125}$ grain). These doses may be repeated in four hours if necessary, but not over 3 mgs. (1–20 grain) should be given in any twenty-four hours. The action of the drug may be apparent in twenty minutes but does not persist for the length of time that digitalis does.

Ouabain (crystalline strophanthin-G) is not official. It is more active than amorphous strophanthin, its dose being about one-half that of the other drug, and is not so readily available in tablet triturates.

Both drugs are quite soluble in water or in physiological saline solution. They should be injected slowly in dilute solution, the doses given above in 2 to 4 cc. (30 to 60 minims) of the solvent. Care must be taken that none of the preparation leaks into the tissues as it will probably cause necrosis. Asepsis must be carefully observed. With such patients, who require intra-

venous medication at beginning treatment, digitalis should also be given by mouth in order that the intravenous injections may be soon discontinued.

CONTINUED MEDICATION.—Patients with advanced heart failure after they have recovered from the most distressing symptoms, frequently require a daily dose of digitalis for long periods. An amount of the tincture sufficient to continue digitalization varies between 0.6 and 1.6 cc. (10 to 25 minims) daily, depending upon the size and susceptibility of the individual. Each patient should be taught the symptoms of minor intoxication and may then soon learn to gauge his own dose. The entire daily dose may be taken at once as the action of digitalis persists, and is best given in the morning.

OTHER DRUGS.—No drug other than one of the digitalis group can compare with its action upon the heart. If a good preparation fails when given in sufficient dosage the cause is probably heart muscle which is so deteriorated that it is beyond all therapy.

If digitalis fails several other drugs may be tried. They are said to stimulate the heart but their action is inconstant, or it is associated with effects upon other body structures which are undesirable in these patients.

Caffeine stimulates the heart and relaxes the blood vessels. It may occasionally be used hypodermically in solution with sodium benzoate in the dose of 0.1 gram ($1\frac{1}{2}$ grains), or it may be used as strong coffee either by mouth or rectum. It has been estimated that one cup of strong coffee contains about 0.2 gram (3 grains) of caffeine. The drug is best used early in the day so that it may not interfere with sleep.

Camphor is said to stimulate the heart in syncope and collapse. Its use is usually disappointing.

Strychnine.—Many clinicians believe strychnine to be a valuable stimulant but advise its use only as an adjunct to digitalis in the treatment of heart failure. Osler advises that strychnine be “given alone or in combination with digitalis in 1 or 2 drop doses of the 1 per cent. solution, or hypodermically in doses of $\frac{1}{40}$ to $\frac{1}{10}$ grain (0.0016 to 0.006 gram).”

Theobromine is especially useful in some cases of obstinate oedema, but its action is apparently upon the kidney. The best preparation is theobromine sodium salicylate, which may be given in doses of 0.6 to 1.0 gram (10 to 15 grains) three times daily. When used for more than three or four days its action ceases, apparently due to fatigue of the kidney. If with the first course no diuresis occur its further administration is useless.

Treatment of Special Symptoms.—**DYSPNŒA.**—The patient first seen with the severe orthopnœa of heart failure is best relieved by the hypodermic administration of morphine sulphate for the first day or two until the effect of digitalis be determined. The chest, especially the bases of the lungs, must always be carefully examined to determine whether or not there is any hydrothorax. Fluid in the pleural cavity is a very potent cause of dyspnœa and cough; it should be promptly aspirated, and the operation repeated as often as is indicated by a recollection of the fluid.

ŒDEMA.—In most patients with heart failure, œdema will subside rapidly with rest, limitation of fluid intake, and efficient medication by digitalis.

Limitation of Fluids.—No matter what the diet may be the fluid intake should not be greater than 1200 cc. (40 ounces) for any patient with heart failure, and often it may advantageously be reduced to 800 cc. (26 ounces) a day. As has been previously noted, the patient with marked symptoms of heart failure seldom has an appetite, so that at the beginning of treatment, the Karrell diet is excellent. It combines a strict limitation of fluid with a reduced easily digestible diet. If milk is not well taken, the food may be toast, cereals, and butter, with water in amount of 800 to 1200 cc. If these measures fail other procedures must be tried.

Salt Poor Diet.—In some obstinate cases in which œdema persists even when the heart is functioning well, the excess of tissue fluid appears to depend upon the presence of an excess of salt in the tissues. This may be caused by inability of the kidney to excrete salt, or it may be due to some disturbance in the tissues caused by the heart failure. In these patients all salt must be excluded from the diet. The diet may consist of cereals, potatoes, and green vegetables but they must be cooked without salt and no salt may be used at the table. Bread should be prepared without salt. The Jewish Matzoth or Passover bread is so prepared and is usually available in the shops. Such a diet may be taken for a week or two before the œdema begins to disappear.

Diuresis.—The use of theobromine has been discussed. It may assist materially in helping to rid the patient of persistent œdema. Theophyllin (theocin) is more powerful as a diuretic but it may produce gastric or renal irritation. Like theobromine its effect disappears after a few days use, and its administration should then be suspended for 4 or 5 days when it may be administered again. The dose is 0.2 to 0.35 gram (3 to 5 grains) three times daily.

Drainage of Œdema.—There are patients in whom œdema persists in spite of the measures outlined above. In these cases the question of draining the legs by incision, or by the use of Southey's tubes may be considered. Usually large amounts of fluid may be extracted by either of these methods. The principal contraindication is the danger of infection and a wide spreading cellulitis in the œdematous subcutaneous tissues. Incisions may be made on either side of the leg just above the malleoli and they should extend through the skin and subcutaneous fat. Southey's tubes are inserted deeply into the subcutaneous tissues of the legs or thighs, a rubber tube is connected to the outer end and is led into a bottle which is hung at the side of the bed. Either procedure must be carried out under exceptional surgical asepsis, through healthy skin, and sterile dressings must be applied. The drainage from the incisions is liable to be very profuse and large pads must be applied to absorb the fluid.

Serous Cavities.—*Hydrothorax.*—A large accumulation of fluid in the thoracic cavity should be removed without delay. Its evacuation gives

great subjective relief to the patient and frequently it appears that the circulation is distinctly better afterward. Even small amounts of fluid, which do not recede in a few days treatment of the general heart failure, should be evacuated.

When large amounts are present, not more than 800 to 1000 cc. (26 to 32 ounces) should be removed at one tapping, as the sudden change in intrathoracic pressure may lead to serious symptoms. The remainder is then removed on the following day. The needle should be removed if there is much coughing or pain. The operation should always be done under local anæsthesia, procaine infiltration, and in nervous patients the injection of a small dose of morphine is often desirable before the operation.

Ascites due to heart failure alone does not often require evacuation. If it does not rapidly absorb as the general œdema subsides it should be aspirated.

Either hydrothorax or ascites may recollect and should then be aspirated as often as is necessary.

Pain.—The association of pain with heart failure is quite frequent. Usually it is of moderate degree and is often described as pressure or fulness beneath the sternum, but it may exceptionally be severe like that of angina pectoris.

Thorough digitalization is the most efficient relief of pain due to heart failure. Locally, either cold or warmth may assist in relieving the discomfort. For severe pain morphine should be used.

The pain associated with some cases of aortic insufficiency is of moderate intensity and may be immediately relieved by a small dose of nitroglycerine on the tongue. The long continued administration of potassium iodide will sometimes permanently relieve this pain.

DISEASES OF THE ARTERIES.

I. ARTERIOSCLEROSIS.

Arteriosclerosis does not produce symptoms until the blood vessel deterioration has progressed to a considerable degree. When this stage has been reached little may be done to rehabilitate the vessels, but measures may be instituted to prevent further damage. The general causes should be borne in mind and when it is found that any of them is operative an attempt must be made to remove them.

Rarely one meets with families, many of the members of which die of some arterial accident. The young of these families should lead a life of simple outdoor activity; they should avoid, whenever possible, the stress of modern business competition, and be moderate always in what they eat and drink.

Treatment.—In the usual patient, where the disease has progressed to some considerable extent before it is discovered, most important in the prevention of further damage is a correction in the habits of life, especially

in so changing the occupation that the wear and tear of physical and mental excesses are lessened. Men with an increased blood pressure, not due to kidney involvement, and beginning stiffness of the walls of the arteries, should "slow down" and learn to play a little. It is not wise for them to give up work entirely, but the hours should be shortened, and, as much as possible, the exhausting emotional stress and detail of the business should be shifted to younger heads. The physician is fortunate if he can so change the occupation of his patient that wear and tear are eliminated entirely, but an interest in life is maintained. In some men this may be done by an absorbing interest in some life long hobby.

Diet.—Many persons of forty to fifty continue the habits of earlier years and eat too much. As man grows older the actual caloric requirement is lessened, and with increasing business cares the physical activity is usually reduced. The whole bulk of food should be cut down, and as a rule its preparation should be much simplified. There does not appear to be any evidence other than clinical experience which teaches that the ingestion of meat should be reduced. The patient can do well on a small serving once daily or even not more than two or three times weekly. Most such patients are better without any soups made of meat stock. A gradual reduction in weight is of value in any of these patients who are overweight, and usually a weight of about ten pounds below that usual for their height is best.

Alcohol should be given up entirely. Tea and coffee may be taken in moderation, one cup of each daily should be sufficient. The use of tobacco is best stopped entirely, but the life long smoker may be made so miserable by the prohibition of all smoking that it is often wiser to limit him to two or three mild cigars daily. He should not inhale the smoke.

There are unusual cases of arteriosclerosis who are underweight and anæmic, whose diet may require an increase. Meat should still be somewhat restricted in these cases, but the starchy food, butter and milk, fruits and vegetables may be increased. Milk either fresh or as buttermilk is an especially valuable article of diet.

The bowels should move freely daily. Whenever possible this should be brought about by a change in the diet—increasing the green vegetables and fruits, sometimes by increasing the amount of the daily water intake. If these measures are ineffective a daily laxative, sufficiently active to prevent straining at stool, should be prescribed. It may be cascara or aloes taken in the evening, or a small dose of Epsom salt or sodium phosphate taken each morning with a glass of water on rising. The preparations of mixed salines and concentrated spring waters which contain sodium chloride are best not taken, as it is held by some that an excess of sodium chloride is responsible for non-nephritic hypertension. The artificial Carlsbad salt (*sal carolinum factitium N. F.*) contains nearly 20 per cent. of sodium chloride.

Bathing.—Cold bathing is usually undesirable as there is too great a disturbance in the blood distribution. A hot bath, over 104° F., will raise blood pressure and pulse rate which are not to be desired in the presence of

possible damage of the cerebral arteries. A warm bath at night is best. Swimming and surf bathing are best not indulged in on account of the incident exertion.

Exercise.—Exercise should not be violent; golf and walking are the best forms of exercise for the patient with arteriosclerosis. In bad weather setting up exercises may be taken every morning, and the patient may walk part of the way to and from his office. No exertion should be carried to the point of exhaustion, and it should in every case be graduated to the condition of the arteries. The pipe stem artery with any blood pressure, or moderately sclerotic arteries with a high blood pressure, should never be subjected to any severe strain. Sudden severe strains are most to be avoided.

Causal.—Individuals exposed to chronic lead intoxication should change their occupation. Those in whom the arterial degeneration is associated with gout or diabetes need adequate treatment for these disorders.

A search should be made in every case for chronic infections—syphilis, malaria, and chronic collections of pus. The latter should be surgically eliminated or freely drained. Syphilis and malaria should be treated with their specific remedies. If one of the arsphenamin preparations is used in arteriosclerosis the dosage should be small and the interval between doses should be at least one week.

Drugs.—For years potassium iodide has been prescribed for arteriosclerosis and many cases are improved by its use. It has been suggested that the case of arteriosclerosis which improves after the administration of the iodides is syphilitic, but the problem is not satisfactorily settled. The iodides seem to promote the absorption of exudates in the walls of blood vessels. The usual dose is 0.3 to 1.0 gram (5 to 15 grains) three times daily, administered in solution and well diluted with water or milk. Its use should be continued for months and the dose need not be increased.

The iodides may produce toxic symptoms—*iodism*—manifested by coryza, frontal sinus pain, a papular eruption, and sometimes tachycardia and tremor which are very like that seen in hyperthyroidism. Some patients are remarkably susceptible and will develop coryza and cedema of the glottis on minute doses.

When anæmia is evident iron, or arsenic in small doses, may be prescribed. Care should be taken that the digestive tract is not disturbed by these drugs, or that the kidneys are not irritated.

II. ANEURISM AND AORTITIS.

Aneurism is practically always preceded by an inflammation of the arterial wall, except in the somewhat rare cases which follow traumatic injury. The inflammation, aortitis, is usually the result of syphilitic infection of some years standing, though a few cases of aneurism have been described as following an aortitis due to one of the infectious diseases, especially rheumatic fever.

The prevention of aortitis is the efficient treatment of syphilis during its early stages.

Treatment.—When aortitis or aneurism has developed a history of syphilis and physical signs of the disease must be searched for. The Wassermann reaction may be helpful. The probable cause of the condition being determined the treatment naturally divides itself into general and local measures designed to lessen the strain upon the diseased vessel, and, in the case of syphilis, causal treatment.

Many patients with these conditions do not come under observation until compelled to do so by attacks of pain, or such symptoms of heart failure as will cause them to stop work. When signs of such conditions are discovered incidental to a general examination treatment should be started without delay; the same may be said of the patient with aortitis who complains only of occasional attacks of cardiac pain. The treatment of heart failure associated with aneurism or with aortitis does not differ from that previously outlined, except in the institution of antisyphilitic measures when the patient has been relieved of the decompensation.

General Measures.—The general measures prescribed for these patients with aortitis do not differ from those outlined for the patient with arteriosclerosis; avoidance of sudden or long continued strain, a simple easily digestible diet, which should not produce overweight, the elimination of alcohol and moderation in the use of tobacco, coffee, and tea; and regulation of the bowels so that straining at stool may be avoided. Mild exercise is best but great care must be taken to avoid strain. When attacks of pain are present exercise is best eliminated until treatment by specific measures has improved the local condition of the arterial wall.

The attacks of acute pain cannot be differentiated from other heart pain and respond to the same remedies. When adequate antisyphilitic treatment has been carried out in these patients with aortitis the attacks of pain will often disappear.

Treatment of Aneurism.—An aneurism is the giving way of part of the arterial wall with bulging of the vessel. Nature makes a constant effort to repair these ruptures by a new growth of connective tissue and the formation of layers of blood clot which subsequently may become organized. When the condition is discovered early it is only reasonable to assist the reparative effort by lessening strain as much as is possible. Even in the late aneurisms much may be done to relieve symptoms.

Strain is most effectively reduced by complete rest in bed, thereby reducing the number of heart beats per minute and preventing the slight increase of blood pressure incident to even mild exertion. Measures designed to reduce the volume of the circulating fluid may be also useful. For this purpose the rigid diet of *Tufnell* was much used formerly. For breakfast, it consisted of two ounces of bread and butter, two ounces of milk or cocoa; dinner, three ounces of meat, three ounces of potato or bread, and four ounces of water or light wine; supper, two ounces of bread and butter, and two ounces of tea. Today the principle of the diet, limitation of food

and of fluid, is still used but more variety is allowed. Rest and diet should be continued for eight to twelve weeks to be effective. Such a procedure may be worth a trial in the early aneurism which has been discovered accidentally, but it is doubtful if it is worth while in large aneurisms. When the pain of pressure by aneurism is severe rest alone will often accomplish its relief.

The administration of drugs designed to increase coagulability has been practically discarded.

SURGERY.—Aneurisms of the peripheral arteries most frequently follow trauma, and are best treated surgically. Ligation, excision, and various plastic operations have been successful, the choice of procedure depending upon the artery involved and the collateral circulation to the part supplied.

For aneurism of the aorta several other procedures have been suggested, all designed with the object of causing clot formation in the sac. These procedures are especially, perhaps only, applicable to the saccular type of aneurism which communicates with the aorta by a narrow opening. The best that may be hoped for is complete clotting and subsequent obliteration, but this is rare. Many patients are however relieved of the severe pain caused by pressure of the aneurismal sac.

Wiring and electrolysis are the best of these procedures. Hollow gold needles insulated from the skin by porcelain or lacquer are used to insert into the sac. The wire may be gold, silver, or platinum, should be of twenty-eight guage, and is wrapped tightly about a small spool to favor coiling after its introduction. The length of wire introduced varies from three to ten feet depending upon the size of the sac. The positive pole of the battery is attached to the wire as, if the current is reversed, the clot produced is soft and friable. The negative pole is attached to a broad plate which is applied to the back. The current used is sixty to eighty milliamperes; it is continued for from forty-five minutes to an hour and a half. The needle is withdrawn over the wire and the wire cut off and buried under the skin. Rigid asepsis must be maintained throughout. Sudden death may occur during or shortly after the operation, but a small number of patients have been much benefited for several years.

Causal Treatment.—When it may be positively determined that aortitis or aneurism is due to some infection other than syphilis there is no specific treatment. Other cases, even in the absence of a positive Wassermann reaction, may be treated with the iodides, mercury or one of the arsphenamin preparations.

As carried out now the usual procedure is to give first a course of mercury and iodides and to follow this with a series of small doses of arsphenamin. If used at the beginning of treatment arsphenamin seems to frequently produce an increase of symptoms which is thought due to a reaction in the diseased tissues following the destruction of numerous spirochætes. Not all patients react in this manner but it may not be pre-

viously determined. In any event the administration of mercury is necessary at some time during the treatment and there seems no objection to starting with it.

A mixture of bichloride of mercury and of potassium iodide may be given by mouth; or the mercury may better be given once weekly as the salicylate, hypodermatically, and potassium iodide separately by mouth. The important part of the treatment is that both be started in small doses, gradually increased over three weeks to tolerance, and continued at this point for another three weeks. After a rest of one or two weeks a course of injections of neoarsphenamin or of arsphenamin should be given. The initial dose should be small, 0.1 to 0.15 gram, and none of the doses should exceed 0.3 gram of arsphenamin, 0.45 of neoarsphenamin. Reactions should be carefully watched for, and, if present, of more than slight intensity, the administration of arsphenamin preparations is best discontinued, and the specific treatment limited to mercury and iodides. A course of six or eight doses of arsphenamin may be given and then after another week's rest, mercury may again be given for six to twelve weeks. The iodides may be continued for a longer time, and it will probably be necessary to repeat the entire course of treatments after one or two months' rest without any medication.

The various forms of mercury and the preparation of solutions of the arsphenamin compounds are described in the section on syphilis.

XVII.

TREATMENT OF DISEASES OF THE NERVOUS SYSTEM.

JAMES HENDRIE LLOYD.

Introductory.—There is a wide-spread feeling that the treatment of nervous diseases does not offer a very fruitful field. This feeling doubtless arises from a consideration of the inveterate chronicity of many nervous affections. But it is a mistake to think that nervous tissue is peculiar in this respect, for it merely shares with all other tissues of the body a fatal tendency to degeneration and decay. There is no reproach that can be brought against it which cannot also be brought against the lungs, the heart, the kidneys or the blood vessels. In fact, some of its vulnerability depends largely on the failure of these other organs to do their appointed work.

This branch of therapeutics presents various aspects. First, there is the question of treatment with drugs. Too much reliance has been placed on this treatment in the not remote past, especially by a certain school who exploited the physiological action of drugs. This kind of empiricism had been elevated into a cult. It was thought that the secret of success lay in the laboratory, where all kinds of mechanical devices were employed to note the actions of the various poisons on the organs of dogs, rabbits, *et al.* An immense mass of data was accumulated, some of which was difficult to master. The faults of this system are numerous. For instance,

it attaches too much importance to the temporary action of drugs; it is superficial and leads to a mere symptomatic treatment; it ignores, almost completely, the causation of disease. It is especially because of this last-named defect that this transcendental therapeutics has tended to give way before the progress of bacteriology. If there is not so much drugging by neurologists today as there was in the former generation, it is largely because the scientific therapist has to reckon with the microbe. There is no encouragement to waste one's energies in a study of the action of drugs that leaves the bacterium and the protozoon out of account.

A tendency has thus increased to rely more and more on hygiene, diet, baths, rest, suggestion, time, and the curative powers of nature. Like all movements, this also has sometimes gone too far and has been responsible for not a little therapeutic trifling. The rest-cure in the hands of some enthusiasts had become a ritual, not without spiritual significance; massage was a sort of "laying on of hands"; suggestion meant any kind of fooling that was supposed to penetrate beneath the surface and duly impress the patient's sub-conscious self. The physician was in some danger of becoming a priest; or, what would be worse, the priest of becoming a physician. Nevertheless, this tendency to rely on something else than drugs has been a beneficent one, and has led to much rational and successful treatment. Its benefits will be pointed out and emphasized in the following pages in all possible ways. It shows not only a scientific but also a humane enlightenment in contrast with the drug fetishism of primitive man.

The most important and interesting branch of therapeutics at present is serology. It is still in the experimental stage, in many provinces, but it has succeeded so brilliantly in some that its achievements are among the best assured of our resources. As a contribution not only to treatment, but especially to diagnosis, upon which all rational treatment must depend, it has been of incalculable benefit to the neurologist. The difficulty is to estimate its probable value in those diseases in which it is still on trial. The attempts will be made in these pages to record the latest results, and to appraise them for what they may seem to be worth. But in a sphere where much may be said to be still in a state of flux, it will be necessary to proceed with caution and conservatism.

Pathology seems at present to be the goal of the scientific physician, but therapeutics is destined to follow close behind. It should share in the benefits attained, not only in the elimination of antiquated and crude methods, but also in the securing of a firm basis for practice.

Finally, the neurologist is in duty bound to contribute his share to the advancement of surgery of the nervous system. Although this is not strictly a therapeutic office, it is so closely allied to it that it is not easy or proper for the neurologist to ignore it. He is called upon not only to assist in the diagnosis, but also to determine when therapeutics should give way to surgery. For this function he is as well, if not better, equipped than most surgeons. The responsibility often rests largely on him; and in the following pages the indications for surgical treatment will be pointed out.

I. MENINGITIS.

There are two forms, usually described apart—inflammation of the dura, and of the pia mater; but the distinction is not of much importance for therapeutics. In fact, the two membranes are not uncommonly involved together. Moreover, meningitis is caused by various agents. It is not one disease. Therefore, rational treatment should, if possible, be directed to the cause, and no one stereotyped plan will do for all. We shall discuss here some of the commoner drugs and measures used in a mere symptomatic treatment, leaving for separate study any special medication that is indicated.

Inflammation of the *dura mater*, or pachymeningitis, is usually caused by septic infection, and may be purulent. The commonest cause is otitis media, but it may also result from other foci of necrosis of bone, especially in the sinuses connected with the nose; also from trauma. The use of drugs in such cases is of secondary importance, and in fact may be futile. Collections of pus may form—the so-called epidural or subdural abscesses—and these can only be removed by surgical treatment. Thrombosis of one or other sinus, especially the lateral or cavernous sinuses, may complicate the case. Syphilis may cause a gummatous inflammation of the dura, sometimes associated with necrosis of the skull, and it is to be treated with specific remedies, as will be described elsewhere.

The temptation to use sedative drugs, such as opiates and the bromides, for the relief of pain, insomnia, etc., should be resisted when pus has collected, for they can do nothing more than mask the grave symptoms. Cold applications to the head are a favorite device, but they are merely palliative. There is a form of so-called inflammation of the dura, known as the *pachymeningitis hemorrhagica* of Virchow, which occurs especially in chronic inebriates and chronic lunatics. Layers of organized blood clots form. Possibly some of these cases are syphilitic. Otherwise they are not amenable to drugs. Leeches, wet cups, and blisters are some of the bizarre remedies which have been recommended in this hemorrhagic form; also surgical removal. But none of these means is to be approved.

Surgical treatment of purulent pachymeningitis, wherever possible, should be prompt; that is, it is to be resorted to as soon as the location of the lesion can be determined. This is a purely surgical problem, but the neurologist may have to give advice. In otitis media a mastoid operation should not be delayed a moment after the symptoms of meningitis appear. The question of brain abscess, remote from the seat of primary infection, is to be determined by the principles of cerebral localization. Such abscesses are most common in the temporal lobe and cerebellum. Cases occur in which a waiting policy alone is possible; in such cases the danger signals are optic neuritis, or papilloedema, and various forms of paralysis of the limbs or cranial nerves. A high leucocytosis of the blood may have significance, and changes in the cerebrospinal fluid. In cases of trauma, causing fracture of the skull, the point of election for operation is usually the seat of the injury, although abscess may form remote from this point in some cases. In cases

arising from necrosis in or about the nasal sinuses, abscess may form in the frontal lobes of the brain. The question of operation in these cases of sinus infection is one for the rhinologist, unless abscess forms in the brain, in which case the aid of the neurologist may be required for diagnosis.

Inflammation of the *pia mater*, or leptomeningitis, is caused by so many different agents that no one plan of treatment will do for all. Among these causes are the spirochæta of syphilis, the bacillus of tuberculosis, the meningococcus of Weichselbaum, the pneumococcus, and not a few others. Meningitis has been reported in cases of influenza, but pathologists do not appear to be agreed about the possible rôle of Pfeiffer's so-called influenza bacillus. In a series of cases reported by Reiche¹ the pneumococcus was found in two and the streptococcus in one, but in most of the cases no organisms were found in the spinal fluid. Some of these cases, however, do not seem to have been clear cases of meningitis. In a recent case observed by Templeton, King, and McKeen² a *bacillus influenzae* was found, but the child had a bilateral purulent otitis. The treatment for most of these diseases will be discussed under their respective headings. In this place we shall merely point out some general indications.

The use of sedative drugs in all these cases requires rare judgment. The temptation to use them, as already said, is great, especially in cases in which pain, restlessness and insomnia are urgent symptoms. Their action in masking symptoms in cases in which surgery may be required, renders them most objectionable in purulent inflammation of the dura, but this objection is not so great in most cases of leptomeningitis. Too often these drugs are prescribed by routine, or in despair, even when their power to do what is claimed of them is obviously lacking. Barbitol, trional, sulphonal and other coal-tar products have some power to act as hypnotics and anodynes, and they may be tried. Their depressing action on the heart must be borne in mind. In a fight with any grave microbial infection, they, as a rule, are losers.

The use of bromides, either alone or in combination with chloral, is advised by many writers to combat the restlessness and insomnia. They are probably more reliable than the coal-tar products. Overdosing should be avoided, especially with chloral. It is to be borne in mind that while the patient sleeps the disease progresses. These drugs cannot control its progress. But if they can relieve suffering, without doing harm, they have performed their office.

Salicylate of sodium and acetylsalicylic acid have been used by some, but their power to control the symptoms of meningitis must be slight.

Opium, in some form, is the best drug in the pharmacopœia really to do what these other drugs are supposed to do. If a sedative, an anodyne, or a hypnotic is required in meningitis, it can be found in opium or morphia. Whatever drawbacks this drug may have, are largely outweighed by the promptness and certainty of its action. If it is given in not too large doses

¹ Deutsch. Zeit. f. Nervenheilk., Jan. 13, 1921. Also Prac. Med. Ser., vol. viii, 1921, p. 31.

² Am. Journ. Med. Sci., May, 1922.

and repeated at sufficient intervals to maintain a mild effect, it will give more relief with less harm than any other. It is usually the overdosing with opium that gives the evil results complained of.

No drugs have a specific action in meningitis, except mercury and arsenic in syphilis. There is no evidence that these two drugs act in any other form of infection than is referred to here. The iodides have been used in late stages with the hope that they would promote the absorption of exudates. They may possibly do so in cases of cerebrospinal meningitis, as well as syphilis.

Hexamethylenamine has come into use in recent years for some action it is supposed to have in modifying the course of meningitis.

Hot baths are useful in some cases for their soothing effects, and act well in treatment with opiates. In cases in which there is great pain on handling, a hot pack may be substituted. Cold packs are usually not so well borne, but when fever runs high, they may be tried. Sponging may be better.

Blisters, wet cups and leeches are time-honored, but to what extent they really do good is a problem.

Lumbar puncture has value as a therapeutic measure, as well as for diagnosis. It was first suggested by Köener. When the fluid is under high pressure, the removal of a portion of it will often relieve headache, restlessness and even convulsions. The frequency with which it is to be done, and the amount of fluid to be withdrawn, must be determined by the circumstances of each case. The subject will be discussed more in detail under separate headings. Trephining, draining the lateral ventricles, and tapping the cisterna magna, have had their advocates. The use of serums and vaccines will be discussed in describing the treatment of the various infections.

Artificial pneumorachis, or injection of air or oxygen into the subarachnoid space, is advised by E. A. Sharp.¹ His conclusion, based on a study of sixty-four cases, including in this group cases of meningitis due to the meningococcus, pneumococcus, streptococcus and tubercle bacillus, as well as cases of typhoid meningitis, lethargic encephalitis and poliomyelitis, is that air or oxygen may safely be injected into the subarachnoid space, and that it acts as a mechanical and possibly as a therapeutic agent in the acute meningitides.

II. CEREBRAL HEMORRHAGE, EMBOLISM, AND THROMBOSIS.

These are the commonest of all nervous affections. Their causes lie in the blood vessels. The walls of these vessels are diseased, as in atheroma or syphilis. They become thickened, hard and brittle, and finally give way. Hemorrhage into the brain tissue thus results; or, if the internal coats of the artery are roughened, a thrombus forms, cutting off the supply of blood and

¹E. A. Sharp, *Arch. of N. and P.*, Dec. 1921, p. 668, also *Trans. Am. Neurolog. Assn.*, 1921, p. 101.

causing softening. The two conditions are so much alike clinically that they cannot be distinguished with certainty, nor is the distinction of practical importance. An embolus is a small particle of granulating tissue, usually from the inner lining of the heart, which is carried by the bloodstream into one of the cerebral arteries, usually the middle cerebral or one of its branches. It also causes softening.

Atheroma of the blood vessels is commonly seen in advanced life, hence these accidents are the causes of the apoplectic and paralytic strokes in persons beyond the meridian. The disease of the blood vessels is often wide-spread, and may be associated with disease of the heart and kidneys.

Cerebral syphilis, however, may occur at any period of life, and hemiplegic attacks are frequently a part of it. It causes thickening of the walls of the vessels; hence hemorrhage is not so common as obstruction. The symptoms may come and go, and the prognosis for improvement, and even cure, is not always bad. It will be discussed more fully under the head of syphilis of the nervous system.

Embolism may arise from an endocarditis, which may be caused in turn by some infection, such as the disease known as malignant endocarditis. Infection of the endocardium is sometimes seen also in scarlet fever, chorea, and rheumatism. Hence a cerebral softening, causing hemiplegia, sometimes occurs in children and young persons.

Thrombosis also occurs in some blood states other than that which causes atheroma, such as chlorosis and anæmia.

The symptoms caused by these various accidents are fully described elsewhere in this work.

There is no curative treatment, properly so-called, for a cerebral hemorrhage or softening. The most that can be done is to relieve some of the symptoms and to assist nature to repair the damage.

An old-fashioned remedy for the apoplectic state is bleeding, but the conditions in which it does good are more probably uræmic than truly apoplectic. It is not easy to see how taking blood from the arm can have any effect upon a hemorrhage which has already occurred in the brain. The subject is argued sometimes from the standpoint of blood pressure, but blood pressure may not be a very reliable guide. It may be low in the apoplectic state, in which case there would be no indication to lower it still further. That bleeding can promote absorption of the clot in the brain, any more than it can arrest a cerebral hemorrhage, is hard to see. In short, the practice is entirely empirical, and will probably be continued, if at all, from force of habit or prejudice. The writer, in hospital practice, has occasionally bled patients for cerebral hemorrhage, but he has never been able to convince himself that it did any good.

If the blood pressure is high, and it is thought best to try to relieve it with drugs, small doses of nitroglycerine or the nitrites may be used. But as these drugs are supposed to dilate the peripheral vessels, there is a theoretical objection to them. It is difficult to estimate either their theoretical advantages or disadvantages, and, practically, they are not of much service.

The iodides could only be used in the hope that they would promote absorption of the clot, but their power to do this must be slight, if any. Moreover, a great deal of the injury is to the brain tissue, upon which the iodides can have no effect.

The use of aconite is based upon its physiological action; but whatever this drug may do in the laboratory, it does not do much for a patient with a cerebral hemorrhage.

Epinephrin has been recommended in the hope that it would control a progressive hemorrhage. This also is largely a theoretical view. As this agent increases blood pressure, its effect upon the cerebral circulation might be disastrous in a case of apoplexy. We have no way of positively determining this question, and such treatment at best is experimental. Applied locally, epinephrin constricts the blood vessels and controls hemorrhage, as in bleeding from the nose, bladder, or uterus,¹ but this is not an indication for its use in cerebral hemorrhage.

Only a little less rational is the application of the Spanish windlass to the limbs to lessen blood pressure by preventing the return of blood to the head. Horsley even advised tying the common carotid artery; and in a few cases, trephining has been tried for deep-seated hemorrhage.²

It is customary to apply an ice-bag to the head, to elevate the head, to use mustard foot-baths, to caution attendants about rough handling, to administer croton oil or some other active purgative, to attend carefully to the bladder, especially avoiding retention, to give a fluid or semifluid diet, and in all possible ways which are suggested by common sense and humanity to promote the patient's welfare. Anxious family and friends demand that something be done, and it is well to do the simplest and least harmful things while pursuing in reality an expectant plan of treatment.

Many of these patients make a partial recovery, but remain hemiplegic. As they regain some power and are able to get about, it will be necessary to prescribe the proper exercise, the time for the resumption of business, the use of massage and electricity, and especially to watch over the functions of the heart and kidneys. Much can be done with care and encouragement to make life useful again and worth living.

Traumatic cases are almost purely surgical. Meningeal clots may cause convulsions, and are sometimes successfully localized and removed.

III. THE CEREBRAL PALSIES OF CHILDREN.

As said in the preceding section, children are sometimes the victims of hemiplegic or similar attacks. The clinical form may be a hemiplegia, a diplegia, a paraplegia, or a monoplegia. These forms are described elsewhere in this work (p. 709, Vol. II). There may be complications, such as idiocy, imbecility, epilepsy and speech defects, and these may require special treatment. Various deformities of the limbs may result, and also need attention, usually surgical.

¹ W. Coleman, in Musser and Kelly, *Practical Treatment*, vol. i, p. 299.

² C. K. Mills, *Nervous System and Its Diseases*, p. 475.

The lesion in these cases is in the brain. An accident at birth, or a prolonged labor, may cause a meningeal hemorrhage. A cerebral hemorrhage has also been caused by the paroxysms of whooping-cough. Embolus may come from an endocarditis, as in rheumatism, chorea, scarlet fever or other infection. There may be a polioencephalitis, just as a poliomyelitis, and due to the same cause. In some cases of infection, thrombi form in the veins. This has been observed, for instance, in typhoid fever. Syphilis, either congenital or early acquired, may cause meningeal and vascular lesions which result in hemiplegia, epilepsy and arrest of development, the so-called *syphilis hereditaria tarda*.

In all these conditions the injury to the brain at an early stage of growth is most serious and usually leads to permanent defects. Nevertheless, something can and must be done for these unfortunates.

Except in the case of syphilis there is no treatment that can be applied with success to the lesions in the brain; the only thing to do is to treat the results as well as possible. It is needless to say that the best possible hygiene must be secured for these children. They are, of course, quite incapable of leading the life of the normal child, and they require constant care and supervision. In many cases institutional care is best for them, especially when their home surroundings are poor and inadequate. They can thus receive that kind and grade of education which is best adapted to them. Not much can be attained in this respect in cases in which great mental defect and epilepsy are present, and too much should not be hoped for or sought. Harm is done by unwise and futile attempts to push such children. The promises held out by some educators of the feeble-minded child, and the hopes and insistent urging of some parents, must be met by the conservative physician with due allowance, but it is neither wise nor ethical to encourage the hope of much improvement. In the milder grades some progress can be made, and this is a problem for the training school. In some cases speech defects can be in a measure corrected with time, patience, and appropriate methods.

Epilepsy is to be controlled, if possible, with bromides; yet it is not well to treat these defective children for long periods with powerful sedatives. Much should depend upon the character and frequency of the fits. Luminal has lately come into use, and may be tried in very chronic and persistent cases. Any seats of possible infection, such as the teeth, tonsils and nasal sinuses, should have attention on general principles. There is no reason to believe that circumcision helps these patients.

Surgery of the limbs is not so promising in these cases as in the ordinary club-foot of infantile palsy or poliomyelitis. The paralysis is spastic, usually of the hemiplegic form, and does not admit of an advantageous use of braces; in fact, many of these children are only more hampered in their movements by such appliances. There is no true muscular atrophy as in the spinal form, consequently there is not the same indication for tenotomies.

Trephining for the intracranial hemorrhage of the new-born has been recommended and tried. According to Frazier the clot is usually intra-

dural and on the convexity of the brain. The accident is more likely to occur in prolonged labors and in the cases of primiparæ. It is not so much due to pressure on the head as to interference with the foetal circulation, due to compression of the placenta. Hence, instrumental delivery may prevent rather than cause it. Nevertheless, injury by the forceps does occur in some cases. The indications for operation may not be plain at first. Signs of asphyxia at birth, subconjunctival hemorrhage, cedema of the eyelids and proptosis, convulsions and paralysis with spasticity of the limbs, are the most reliable symptoms. The question is, of course, a surgical one, and is to be determined with the aid of a surgeon who has special experience in brain surgery. The advice of the neurologist is to be based largely on the signs of cerebral localization. It is to be borne in mind, however, that the injury to the delicate cortex of the new-born may be great and permanent, and that such an operation, even if successful for the removal of a meningeal clot, does not necessarily prevent the sequelæ of such a lesion, such as hemiplegia, epilepsy, and imbecility.

In older children with epilepsy of the Jacksonian type, the temptation to operate may be great, and trephining has sometimes been done in a forlorn hope. But the extent of injury to the brain tissue is usually so great, and the case is of such long standing, that little or no good is accomplished as a rule. The monstrous operation of Lannelogue, suggested some years ago, for the removal or elevation of large sections of the skull, with a view of securing decompression in cases of idiocy, is mentioned only to be condemned.

IV. SENILE DEGENERATION.

Among the effects of vascular disease, such as atheroma, are the changes in the central nervous system peculiar to old age. All these changes, however, may not be secondary to vascular disease; there are degenerative changes in the nerve cells that are of obscure origin, and are probably a part of the inevitable decay that occurs in senility. Possibly they may be caused by alterations in the secretions of the ductless glands. The heart and kidneys also are often at fault. These various facts—or inferences—make the treatment of nervous diseases in old people a rather complicated one. A few of the chief factors only will be discussed here.

Early symptoms of atheroma may be tinnitus, vertigo, throbbing or fullness in the head, transient attacks of mental confusion, slight paresis, aphasia and headache (p. 725, Vol. II). Such symptoms are best relieved by regulation of the diet and daily habits, and a slightly depleting treatment by action on the bowels and by attention to the functions of the kidneys. If the circulation in the extremities is sluggish, and the blood pressure not too high, small doses of digitalis are helpful. This drug is of benefit when there is cardiac weakness, but the risk to the weakened arteries in the brain contraindicates its use in large doses. Alcohol, in spite of the prejudice in its favor, is not always borne well in old age, and the tendency of some old

people to abuse it must not be ignored. Evil habits creep on insidiously in the aged, even in those who have always led strictly temperate lives. The writer once saw alcoholic multiple neuritis in an old man, caused by an unsuspected abuse of whiskey. As Bevan Lewis pointed out, the excessive use of alcohol lends impetus to the retrograde changes which naturally occur in the brain in old age. Something may be said for opium. A moderate daily dose of this drug, especially by suppository at night, is allowable in persons who suffer from some of the infirmities of old age, especially sleeplessness, worry, and depression. There are some old people for whom life would hardly be possible without it. A mild opium habit is undoubtedly thus formed, but it can be regulated and the dose not increased for astonishingly long periods. The patient should not be allowed to have control of the dosage. The bromides may relieve temporarily some of the cerebral symptoms, such as tinnitus, fulness of the head, and vertigo, but their general effects are objectionable when these salts are used in full doses and habitually. Strychnia has won such favor as a nerve tonic that it is given as a matter of course to all kinds of run-down people, but there is little reason to believe that it has any great potency in the nervous diseases of old age. Nux vomica, combined with a bitter tonic, is a favorite remedy.

The treatment of cardiovascular and renal disorders is discussed elsewhere in this volume. The importance of these disorders in all senile affections is never to be overlooked.

The administration of certain glandular extracts, especially of the testicles of some of the lower animals, has threatened to become a fad, but the writer does not feel competent to express an opinion about their utility in the cases of those persons upon whom has been passed the sentence of old age.

V. ABSCESS OF THE BRAIN.

The treatment of abscess of the brain is almost entirely surgical, but the problem of its diagnosis and localization is often one for the neurologist. The subject is discussed elsewhere in this work (p. 698, Vol. II), and it will be referred to here in some detail as it presents itself to the practitioner.

The commonest cause is purulent otitis media. Cases arise in which symptoms of invasion of the brain occur, and yet the symptoms of formation of pus may not be clear. The question of operation in such cases must be held in abeyance, because it is not clear what to do. A waiting policy must be pursued, but the physician feels he is on dangerous ground. A mastoid operation is, of course, to be done; but this does not always relieve all the symptoms; at least, not at once. Thus in the case of a young woman symptoms of meningeal irritation persisted after a very thorough opening and clearing out of the mastoid. There was headache, with fever, stiffness of the muscles of the back of the neck, and slightly choked disks, but the cerebrospinal fluid was negative, nor were there any signs of a localization of pus. In this case an expectant treatment, with thorough drainage of the mastoid wound, in time brought cure. Whether the use of an anti-strepto-

coccic serum in such a case would be of any avail, the writer does not know, nor whether the future holds any promise of such a remedy. Cold applications to the head may be palliative, and mild sedatives to relieve pain and insomnia may be used; but the use of the latter is a necessary evil, for, as said elsewhere, they may mask symptoms when a collection of pus is forming. If the physician is driven to it, probably a very mild opiate is the best, but this suggestion is made here with considerable reserve. Bromides and the various coal-tar products are not of much use in such a case.

The question of an exploratory operation in a case of suspected abscess may come up. The temporo-sphenoidal lobe and the cerebellum are the seats of the majority of abscesses arising from otitis media. Frazier says that the proportion of the number of abscesses in the temporo-sphenoidal lobe is two to one. The general symptoms of brain abscess may be present, such as headache, choked disks, vertigo, fever, nausea and vomiting, and changes in the cerebrospinal fluid. Focal symptoms may not be conspicuous, or may even be entirely absent. The most characteristic is word-deafness when the lesion is on the left side. Hemiplegic symptoms are not common, but may be present if the abscess is large enough to make pressure on the motor tracts within the brain. Sensory symptoms also may occur, but they are difficult to detect and interpret. Various forms of hemianopsia are caused by tumors of the temporal lobe, and might be caused also by abscess. Convulsions, if they occur, may either be general and without localizing value, or if they are of the Jacksonian type, they may indicate invasion of, or pressure upon, the motor area. Stupor may be present.

Abscess of the cerebellum may cause vertigo, ataxia, dysmetria, alterations in the patellar reflexes, in addition to the general symptoms, of which choked disks are common; but the location of cerebellar abscess is often difficult to determine.

Abscess caused by infection from suppurative disease of the bones or sinuses of the nose, may be located in one or other of the frontal lobes.

As a metastatic abscess may be caused by a purulent focus in some other part of the body, such as empyema or endocarditis, or septicæmia from any cause, it is necessary to interpret most carefully any symptoms of intracranial lesion that may occur in such cases.

Exploratory operation in all cases of suspected abscess of the brain is a question for the brain surgeon in consultation with the neurologist. In the case of a suppurating middle ear, the point of election is over the temporal lobe, unless the indications are in favor of a cerebellar location. The problem may be most obscure. Treatment with drugs is futile, and delay may be fatal. The x-ray should be used for diagnosis.

Latent abscess of the brain may be of long standing, and give rise to few if any symptoms. It is usually walled off, or encapsulated. There may be headache and changes of character and disposition; possibly also a mild grade of optic neuritis or choked disks. Grave symptoms may occur suddenly from the rupture of the walls of such an abscess. In the case of a

young man, who had sometime previously received a severe blow on the head in a boxing bout, a hemiplegia suddenly occurred, with stupor. An operation over the Rolandic area failed to reveal the cause, but at autopsy a deep-seated abscess was found in the cerebral hemisphere.

Fever with chills may occur in cases of abscess; also slowing of the pulse, and in long standing cases, emaciation. The cerebrospinal fluid may or may not show a leucocytosis; if the abscess is walled off, changes in this fluid may not be found. This is a subject, however, which requires further study. Leucocytosis of the blood may not be marked.

VI. HYDROCEPHALUS.

This condition, which is described elsewhere (p. 713, Vol. II), is usually attributed to occlusion of one or other of the foramina of the brain, but the primary cause of the occlusion is not clear, especially in the early or congenital cases. Barlow has described a posterior basilar meningitis, which causes a closure of the foramen of Magendie, with consequent distention of the ventricles.

The treatment, such as it is, is entirely surgical. Various plans for draining the ventricles have been devised, and some of them put in practice; but the treatment is still in an experimental stage, and it is not one which, in the writer's judgment, offers much promise of success. The ventricles have been drained into the subdural space, into the cellular tissues of the scalp, or of the lumbar region, into the abdominal cavity, or the pleural cavity, and into the longitudinal sinus or even the jugular vein.¹ Dandy recommends the extirpation of the choroid plexus.² As these procedures are entirely surgical, they need not be discussed here in detail. Treatment with drugs in these cases is of no avail. Compression of the skull has been recommended, but it is barbarous, unscientific and not to be considered.

VII. TUMORS OF THE BRAIN.

The treatment for these growths is of two kinds, symptomatic and surgical. There is no curative treatment for them with drugs, unless it possibly be in some cases of syphilitic tumor.

The symptomatic treatment is, of course, merely palliative, but it is important, because the demand for relief of some of these symptoms is most urgent.

Headache is a very common symptom of brain tumor, and in many cases it is intense. To combat it with drugs is usually unsatisfactory, because the relief is only temporary and not always complete. Hence the necessity for continued use of these remedies and the occurrence of many of their objectionable effects. Nevertheless, the physician is usually driven to their use.

¹ Frazier, in Musser & Kelly, *Pract. Treat.*, vol. iii, p. 780.

² Dandy, W. E., *Am Surg. Aug.* 1919., for results of experiments; also, *ibid.*, Dec., 1918.

The opiates, especially morphia, are most reliable for their immediate effects, but the objections to their use are obvious. They induce the habit, and their physiological effects may be injurious, but to add the opium habit to the symptom-complex of brain tumor is not always blameworthy. In cases in which stupor is present they are contraindicated.

Morphia and bromide of potassium are the two drugs which offer the most promise in these fatal cases.¹ This opinion has stood the test of a good many years. This combination can, in a measure, control the headache, the vomiting and the epileptic seizures. Although the vomiting is cerebral in type, or in other words, of central origin, it is possible in some cases to give relief by remedies applied directly to the stomach, such as the salts of bismuth and cerium, champagne and cracked ice.

Among the drugs that have been recommended in these cases are cannabis indica and hyoscyamus. Such things as sulphonal, trional, barbital and acetylsalicylic acid are almost sure to be tried at one time or another, and their use and dosage will depend on the experience—or faith—of the physician.

Local remedies have been much resorted to in the past, such as the ice-bag, wet cups, leeches, and even hot compresses to the head. Strange as it may seem, ergot was once suggested for its supposed power to control “congestive” attacks.

Surgery offers the only radical treatment for a tumor of the brain. Since the historic case of Hughes-Bennett of London, in which operation was done by Godlee in 1885, great advances have been made in this operative treatment. It was supposed at that time that only tumors located in or near the motor cortex could be successfully diagnosed and removed; but later study and experience have greatly enlarged the field of successful operation. Not only tumors of the motor region, but also those of the frontal lobes, of the temporal lobes, of the parieto-occipital region, and of the cerebellum and cerebello-pontile angle, not to speak of the pituitary body, are now localized and removed. The subject is large, and is almost so entirely surgical that only a brief discussion is called for here. The diagnosis of these growths is discussed elsewhere (p. 716, Vol. II).

The first question which is likely to present itself to the neurologist is decompression. This is a palliative measure, and is to be resorted to particularly in cases in which radical treatment, or removal, may be impossible. The object is to relieve headache and vomiting, and especially to save the eyesight in cases in which the optic nerves are threatened with destruction. A rapidly advancing state of choked disks is the most important sign, and calls promptly for such relief as decompression can afford, especially in cases in which it is probable that the case, otherwise, is inoperable. It may even be called for as a preliminary step in cases in which delay in a radical operation may be unavoidable, as for instance, when the location of the tumor cannot be determined as yet with certainty. Even in advanced and inoperable cases decompression, by

¹ Mills and Lloyd in Pepper's Syst. of Med., vol. v, p. 1068.

affording relief to headache and other symptoms due to increased intracranial pressure, is indicated, and is better than an exclusive reliance on drugs. An exploratory operation, in uncertain cases, even if it does not lead to a discovery of the tumor, may do good as a decompressing measure. Thus in the case of a woman in which such an operation was done, although the tumor was not located, yet the papilloedema was relieved, the eyesight was saved, headache and convulsions were greatly controlled, and the patient survived in comparative comfort for several years. The point usually chosen for a decompressive operation is underneath the temporal muscle (subtemporal decompression); and it should be done on the right side to avoid the speech zone. The temporal muscle gives support to the meninges, and tends to prevent a large cranial hernia. If the growth is a subtentorial one, the operation for decompression should be done on the occipital bone.

But the operation for decompression is severely criticized by Dandy, who thinks that it should be performed only as a last resort. He claims much for his method of injecting air into the ventricles as a means of localizing the tumor.¹

Excision of the sheath of the optic nerve, instead of decompression, is recommended by Kubik.² What advantage there can be in such an operation, it is difficult to see.

Tumors of the pituitary body are of more than usual interest to the clinician because of the general or constitutional symptoms which they cause. This dyscrasia may be either the condition known as acromegaly, or the *dystrophia adiposo genitalis* (p. 719, Vol. II). Gigantism or dwarfism, as the case may be, is occasionally seen. Diabetes insipidus is believed by some to be merely a symptom of disordered function of the pituitary body, possibly a deficit of secretion.³ Hypophysial extract has been used in such cases with alleged good effect. It may be given by mouth or by injection. Caution is needed, however, both in the use and the praise of this extract. Frank well says that the practice of applying unconfirmed results obtained in the laboratory to clinical cases is pernicious. There is no reason to believe that this extract can control the growth of an hypophysial tumor. The radical treatment for such tumors is by surgical removal, as practised especially by Cushing and by Frazier.

It is unwise to depend on alterative treatment, as with mercury, arsphenamin and the iodides, in cases of brain tumor. Prolonged treatment with such drugs is only a waste of time, and may sacrifice the chances of successful operation, for such alterative treatment is of no use unless possibly in cases of suspected or demonstrated syphilis. But even in the case of a gumma, if it is a large one, specific treatment may fail, although it should be given a thorough trial. If a large gummatous tumor is in a position to be removed, it can be treated as any other growth and excised. But the patient should also have specific treatment, because such a gumma may

¹ Journ. A. M. Assn., Dec. 10, 1921, also, Surg. Gynec. and Obstet., April, 1920.

² Klin. Monatsbl. f. Augenheilk., June, 1921, also Pract. Med. Ser. vol. viii, p. 89.

³ Motzfeldt, Endocrinology, April-June, 1918; also Pract. Med. Series, 1918, p. 198.

be associated with wide-spread gummatous meningitis. Horsley, in 1910, even recommended irrigation of the brain in such cases, with a 1 to 1000 solution of mercuric chloride. Syphilitic tumors of the brain have been successfully removed by Horsley, Macewen and others.

Frazier has tried radium in twenty-five cases of brain tumor and found it useful in pituitary growths and endotheliomata, but he does not think it has any effect on gliomata.¹

The diagnosis and site of a tumor of the brain is to be determined on the principles of cerebral localization. When operation is decided on, it is useless, as a rule, to continue to treat symptoms, unless such symptoms as headache, vomiting, and convulsions should continue to be severe, especially after operation. These are then to be met by some of the means already suggested. If convulsions continue, they should be controlled with the bromides. It is not clear that the iodides would have effect to cure the results of an optic neuritis or papilledema which persisted after operation. The postoperative treatment of all symptoms, however, is in the hands of the surgeon.

The so-called serous meningitis may simulate a tumor of the brain, and it is now becoming customary to speak of a "pseudotumor," by which is meant a meningitis walling off a collection of fluid in the ventricles and basal cisterns. Thus in a recent case in a young woman, under the writer's care, in which choked disks had advanced to complete blindness and the symptoms indicated a subtentorial growth, suboccipital craniotomy was done by Frazier. A tumor was not found, but excessive fluid was drained off from the ventricles, with relief to headache, but without restoration of sight. In such a case the possibility of a glioma of the brain-stem, not demonstrable by operation, must be borne in mind.

VIII. INTRACRANIAL ANEURISMS.

Not much can be said, unfortunately, for the treatment of intracranial aneurisms. The diagnosis is discussed elsewhere (p. 714, Vol. II). It is difficult in some cases to distinguish them from tumors. The iodide of potassium has been recommended for aneurism of the aorta, and it is to be presumed that any benefit it might have in such cases could also be secured in the intracranial forms; but this benefit is doubtful, according to those who have used it. Rest in bed and special diets cannot cure, even if they ameliorate some of the symptoms. The question of the ligation of one or other artery, especially the common carotid, is a surgical one, but such an operation does not promise much, and, of course, it is a hazardous one.

Headache, vomiting and the sense of pulsation in the head, may call for the use of the bromides. In cases of great pain and distress, morphia is of use as a palliative. It is possible that a decompressive operation, just as in the case of brain tumor, might afford some relief,

¹ Discussion of papers by T. J. Bagg, J. Ewing, and D. Quick, *Journ. Nerv. and Ment. Dis.*, Feb., 1921.

but the writer has had no experience with it in aneurism. Whether there are any theoretical objections to it—whether, for instance, it might, by removing pressure, allow the aneurism to expand more rapidly, and even create a risk of its rupture—is not clear.

The subcutaneous injection of gelatine with the object of increasing the coagulability of the blood, has been tried in cases of other aneurisms. But this practice may not be without risk, for gelatine is said to cause increase of intravascular pressure, and this might lead to rupture of an aneurism, the walls of which were thin. There is said also to be some risk of the formation of thrombi. The internal administration of calcium chloride, and the subcutaneous injection of horse serum, have also been tried in order to increase the coagulability of the blood.¹ Their utility in intracranial aneurism is thus far a matter of doubt.

Any method, such as by ligature or the formation of a clot, that causes obstruction of the circulation in the brain, would be about as bad as the disease itself.

IX. MULTIPLE SCLEROSIS.

This disease can hardly be said as yet to occupy a place in any scheme of therapeutics. It is chronic and incurable, so that the only thing to do for these patients is to relieve, as far as possible, the infirmities which they share with many chronic invalids.

Multiple sclerosis is marked by foci of degeneration scattered through the brain and spinal cord (p. 716, Vol. II). These foci consist of proliferated neuroglial tissue. They vary in size, and the cause of them is unknown. They cause an intention tremor, spastic paresis, especially of the lower limbs, nystagmus and scanning speech. The onset is usually in early life, and the disease is rather more common in young women. These patients may, and often do, live for years. Such light occupation with the hands as their impairment admits of, is the best thing for them, although it is rather for diversion than for utility. But the intention tremor sadly impairs the use of their hands, even for dressing and feeding themselves, while the spastic paralysis often confines these patients to their chairs. Bed-sores are not common, unless in very advanced bed-ridden cases. In fact, the general health may continue fair for long periods. Remissions may even occur, but they offer no prospect of cure. In some cases mental changes are observed. Epilepsy is not a complication; or at least, if it occurs, it is very rare.² Apoplectiform attacks are occasionally seen. Fortunately these patients do not suffer pain; and in spite of the chronicity and disabling character of the disease, they usually are of a cheerful mind. There is little or nothing to be accomplished with drugs. Attention to their general wants, and good routine nursing, are the indications for treatment. Sedative and alterative drugs are useless and pernicious. Tonics may be useful at times, but strychnia is to be avoided.

¹Sajous, *Encyc. Prac. Med.*, Vol. I, p. 676.

²Patrick, Jr. *Nerv. and Ment. Dis.*, March, 1918.

It is proper to add, for what it is worth, and in rebuttal of some of the above statements, that claims have been made by some recent German writers that arspnenamin is of use in the treatment of multiple sclerosis. The treatment of this disease with arsenic is not new, but this treatment with arspnenamin appears to be based on the alleged finding of spirochætes in the cerebral foci by Siemerling and others. It is not clear that these are the organisms of syphilis, or even that they are the cause of the disease, although some inoculation experiments have apparently succeeded. Wichura claimed good results from arspnenamin in small and frequent doses in two cases; and a few others have reported similar results from the new silver salvarsan.¹ Byrnes and others have recommended an antisyphilitic treatment with mercury and arspnenamin.²

X. PARASITES IN THE BRAIN.

From the practical standpoint these might be classed with tumors, because the only possible way to relieve the patient would be by operation. But the question of operation is beset with many difficulties, even greater than in the case of tumor. The commonest of these parasites is the *cysticercus cellulosæ*, which is the larval form of the pork tape-worm (p. 720, Vol. II). The eggs are ingested in some article of food or drink, and are hatched in the stomach or intestines; the larvæ are then carried to various parts of the body, such as the muscles, brain, retina, etc., where they develop as cysts. Autoinfestation is not the rule; that is, the human victim is not usually himself infested with an adult tape-worm in the intestine. Hence there is no indication here for treatment. As the eggs are introduced from without, it is evident that care and cleanliness in the preparation of food are the best, and indeed only, preventives.

The echinococcus, or hydatid, which is another form of tape-worm, is occasionally seen. It may be associated with hydatid cysts in other parts of the body.

As these parasitic cysts usually find lodgment deep within the brain, the surgical treatment is not promising. The commonest location for them is in the lateral and fourth ventricles, where they float free, or are lodged in the walls. Sometimes they are found in the substance of the brain or beneath the membranes. They usually cause great increase of the fluid and distention of the ventricles.

In case one of these cysts had formed in the substance of the brain, it might cause localizing symptoms just as in the case of a tumor, and might be excised; but as there are usually multiple cysts, such removal might not cure the patient. Puncture of the lateral ventricles would relieve pressure, but this would be only a temporary relief, and hardly worth the risk of such an operation. As the aqueduct of Sylvius may be occluded, lumbar puncture might not be a means of drawing off the fluid in such cases. Moreover,

¹Pract. Med. Series, Vol. viii, 1920, pp. 117-118.

²C. M. Byrnes, Journ. A. M. Assn., Mar. 25, 1922.

it is just possible that draining the ventricles might have disastrous effects by permitting the cysts to make even firmer pressure on the walls of these cavities.

XI. CEREBROSPINAL SYPHILIS.

It is better to discuss this subject here as a whole than to treat of the syphilitic affections of the brain separately from those of the spinal cord. When the spirochætes of syphilis invade the central nervous system, they do not always confine themselves either to the brain on the one hand, or to the cord on the other. There is likely to be a more generalized infection, for syphilis is one and the same disease, and is to be combated with the same means, however and wherever it may show its most conspicuous ravages. For descriptive purposes it is, of course, necessary to separate the syphilitic syndromes of the brain from those of the spinal cord, and this has been done in another part of this work. There have been writers who have maintained that syphilis of the nervous system is always generalized; that there is no strictly limited cerebral syphilis as distinct from syphilis of the spinal cord, or *vice versa*. This is a rather extreme opinion, for cases do occur which, from the clinical viewpoint, preserve one or other type; nevertheless, in such cases a strict search might reveal that some obscure symptoms, either of the brain or cord, had been overlooked.

There is another distinction, however, which must be borne in mind; the distinction between the so-called parasymphilitic diseases and the wide group of vascular and meningeal affections which we call cerebrospinal syphilis. Paresis and tabes are now known to be syphilitic diseases, yet there are differences in the pathology, and a resistance to treatment, which still keep them in a class apart. It is idle to deny this, for it is borne out by the widest experience. The suggestion has been made, and some proof offered, that there is more than one strain or variety of the spirochæte, and it might be inferred that a special kind is the cause of general paresis and locomotor ataxia. This is a subject which may have a direct bearing on treatment when more is known about it, but for the present it offers no indications that were not known before.¹

In discussing treatment, while the general view will be kept prominent, the local affections will be given proper place.

The first point of importance is the very early invasion of the nervous system. It is no longer allowable to speak of nervous syphilis as always a "tertiary" manifestation. It may appear in the late primary or early secondary stage. The spirochætes make their way into the circulation probably in a very few days after the primary sore, or, in fact, before the primary sore is fully formed. They may find lodgment in the central nervous system long before they give any clinical signs of their presence; or they may be present in the florid stage and act on the membranes, caus-

¹ B. P. Thom, Strain in Spirochætes, Amer. Jr. of Syph., Jan., 1921, p. 9. Noguchi even claims that there are differences in the size of the spirochætes.

ing some of the obscure symptoms, such as headache and other pain. A large percentage of syphilitics show some changes in the cerebrospinal fluid in the early period, whether these be due to a toxæmia or to the actual presence of the spirochætes. These changes do not persist in all cases, but the fact that they do persist in a number of cases suggests that these particular patients may be candidates for future nervous affections. A positive Wassermann reaction in the blood may be found as early as seven days after the primary sore: 50 to 60 per cent. of patients give positive reactions during the second week.¹

It is not a new idea that the lesions of syphilis may occur very soon after the infection. Cazenave in 1843, opposing Ricord, said they may occur at any time, no matter how near or how far after the first contact.² Invasion of the central nervous system at a very early date has been observed a number of times. A recent observer claimed that he saw nerve deafness in seven days; and Randall saw nerve deafness follow an infected needle wound of the finger in four weeks. Read reported marked symptoms of syphilis of the nervous system two weeks after the appearance of the chancre. Wile and Stokes reported four out of six cases in the second incubation period, that is, before any skin eruption had appeared, in which both clinical and laboratory evidence of involvement of the central nervous system was found.³ Gilles de la Tourette described a severe case of cerebrospinal syphilis which developed two months after the infection, and Fournier reported a case in which the interval was three months. Nonne also has seen very precocious cases.⁴ The present writer has seen bilateral involvement of the seventh and eighth nerves occur three months after the primary sore.⁵

In a circular of the Surgeon General's office the rule is laid down that no patient should be treated for early syphilis until a positive diagnosis is made, either by demonstration of the spirochæte or by positive Wassermann reaction.⁶ This refers to the finding of the spirochæte in exudates from the primary sore by dark-field illumination, and to the test of the blood. But by the time most of these patients present themselves with nervous syphilis the primary sore has long healed, and reliance has to be placed, as far as possible, on the history of the case and the laboratory findings. The examination at this stage is not complete without that of the cerebrospinal fluid; and, in fact, from what has been said above, it is evident that this fluid may show changes, and should be tested, in the early stage.

But in spite of hard-and-fast rules patients present themselves in every nervous clinic with symptoms highly suggestive of nervous syphilis, but without a history of infection, and even with negative reports from the laboratory. In such cases the neurologist relies on his prerogatives as a clinician. He may be able at the bedside, from his own experience, to

¹ Hazen, Syphilis, p. 501.

² Quoted by Thompson, Syphilis, p. 55.

³ *Ibid*; also other instances, p. 317 *et seq.*

⁴ Nonne, Syphilis of the Nerv. Sys., p. 50.

⁵ Lloyd, Syphilis of the Eighth Nerve, Arch. of Neur. & Psych., May, 1921.

⁶ Circular No. 14, W. D. Office of Surg. Gen., p. 4.

recognize obscure symptoms, and he should give the patient the benefit of the doubt, *i.e.*, treat him for lues. Cases without a history of primary lesion are called by the French "syphilis d'emblée." Ignorance of the lesion is the explanation of most of these cases, but it is well to recall that the spirochætes can enter the body by other portals than a chancre, as in prenatal and experimental cases. They are present in the semen, but whether they can be transmitted by means of this fluid has not yet been demonstrated. As is well known, the history of a primary sore in women is often impossible to elicit, but this is because of special difficulties. Infection *per uterum* is not to be considered impossible.¹

There are two drugs, mercury and arsenic, which are regarded as specifics in the treatment of syphilis. By the word "specific" is meant that these two drugs are believed to kill the organisms of lues. That they diminish their number or their activity, appears abundantly proven; and that they can eradicate them entirely, is the fond belief of many therapeutists. Nevertheless, it has long been notorious that syphilis does not always stay cured. In no other disease is it so true as in this that eternal vigilance is the price of health.

This warning is particularly needed in the case of syphilis of the nervous system. Since the introduction of arsphenamin there has been an era of hope, but there has also been far too much enthusiasm. We already note a reaction, and it is just possible that eventually arsenic will take its place with mercury as an old standby, while the spirochæte will continue to flourish. It is estimated that there are 8,000,000 syphilitics in the United States. Hence this is a vast hygienic problem, but in these pages the therapeutics alone of the disease will be discussed.

Mercury has held its own for so long in the treatment of syphilis that it is not necessary to defend it. It has not been displaced by arsenic, and in the opinion of not a few practitioners it is not likely to be. The best method of administering it in nervous syphilis is by inunction. When given by the mouth in these cases it does not seem to do its work so well, and the writer confesses to a prejudice against its use in that way. If, however, it is deemed well to use it by mouth because of convenience and secrecy, the best preparations are probably the protiodide, gray powder, and the bichloride combined with iodide of potassium. In whatever way it is given, it can be used in conjunction with treatment with arsenic. In very acute cases the inunctions should be given daily, with due precautions against pytalism. There is an opinion that syphilitics show an unusual tolerance of the drug; instances are given of its use over very prolonged periods without undue constitutional effects.² Nevertheless, care should be taken, for it is undesirable to cause a mercurial toxæmia. The preparation commonly used is the blue ointment, but of recent years the *unguentum cinereum* has also found favor. In cases in which a daily inunction is given the appli-

¹L. Findlay, *Syphilis in Childhood* (p. 1 *et seq.*), discusses this whole subject in its bearing on hereditary syphilis.

²Findlay, *Syphilis in Childhood*, p. 131, says he has continued inunctions for a year in infants, and yet has never seen the slightest evidence of toxæmia in them.

cations should be made to various regions in turn, as to the inner sides of the thighs, of the arms, to the thorax and to the abdomen. It is best not to have the patient do the rubbing (as is sometimes recommended), but to have it done by a reliable attendant, who should wear a rubber glove and be cautioned against the risk of mercurializing himself or herself. Nonne¹ says, when it is possible to carry it out, insist upon treatment with mercurial inunctions, because it is the most thorough and quickest in effect. Neumann, of Vienna, came to the same conclusion.

It is not possible, with profit, to lay down precise rules about the number of inunctions. Some writers tell us about "cycles," by which they mean a set number of inunctions on a certain number of days, followed by a bath. Others suggest as many inunctions as thirty; this is Nonne's advice. But every man must think for himself; the best rule is to watch the symptoms and the effect on them, and to keep a check on the case by regular tests of the blood and spinal fluid. If ptyalism appears, the rubbings are to be stopped. When the symptoms yield, the treatment may be superseded by a course of the iodides.

Intra-muscular and subcutaneous injections of various preparations of mercury have been much used by syphilologists lately, and they have been advised in cases of nervous syphilis. Their merits are claimed to be their quickness and efficiency. Certainly if there is any form of syphilis that demands prompt and heroic action, it is syphilis of the brain and cord, so this method may have something in its favor, but the probability is that it has been to some extent displaced by the injections of arsphenamin. Its great disadvantages are its proneness to cause a local abscess, and the difficulty of controlling the action of the drug. The practice dates from Lewin's work in 1869, and the bichloride was apparently the form first used.² Since that time many preparations of mercury, both soluble and insoluble, have been employed; and merely to enumerate them would take much space. The chief ones, besides the bichloride, are metallic mercury, gray oil, calomel, the salicylate, the benzoate, the succinimide, and the biniodide. These varieties all have their advocates, and it is hard to decide among them. Probably the differences in therapeutic effects are not great; but the chances of the insoluble forms, such as calomel, causing abscess must not be ignored. The injections are usually made into the nates. Loyd Thompson calls attention to the risk of embolism and mercurial poisoning by the insoluble preparations. Nonne, in treating nervous syphilis, recommends an injection of a 10 per cent. solution of salicylate of mercury into the nates every four or five days when the symptoms "do not disappear quickly enough" on treatment with inunction. Potter prefers intra-muscular injections to inunctions in the treatment of syphilis in general.³ He uses the insoluble basic salicylate. After injections, the patients sometimes show slight reaction, such as chilliness, headache, malaise, and a

¹ Syphilis of Nerv. Syst., p. 358.

² Lewin, *Behandlung der Syphilis*, etc., Berlin 1869, also Thompson, *Syphilis*, p. 198; also Nonne, *Syph. Nerv. Syst.*, p. 358.

³ *Internal Medicine*, Wilson & Potter, p. 650.

little fever. By way of comment, the present writer can say that he succeeded in forming a large abscess in the buttock in one case, and he does not believe injections are to be preferred to inunctions.

Horsley, in 1910, recommended subarachnoid lavage with a solution of mercuric chloride, in cases of syphilis of the brain, but his suggestion did not meet with favor.¹ The same is true of Sicard's plan of subarachnoid injections of mercuric cyanide. Byrnes' treatment is with injections of mercurialized serum into the spinal subarachnoid space.² The solution is made by adding from 1.3 to 2.6 mg. of mercuric chloride to 12 cc. of human serum, diluted with 18 cc. of normal salt solution. This method has met with some favor: the injections may be used alternately with arsphenaminized serum. The present writer has had no experience with this treatment, nor with the methods of injecting the ventricles of the brain or the cisterna magna, which have been proposed by some surgeons and neurologists.³ The intravenous injection of mercury, which was proposed by Baccelli in 1893, has never been used extensively in the treatment of cerebrospinal syphilis, and is not recommended in these pages.

Hazen says that mercury usually causes the lesions of syphilis, even in the brain and cord, to disappear; but that the Wassermann test shows that the vast majority of patients are not cured, and that "the treponema is simply kept chained."⁴ According to Nichols, this drug cannot kill the organisms unless it also severely injures the patient. Hazen thinks it is questionable whether mercury has ever cured syphilis. But there are many neurologists who will insist that it at least helps them for long periods. If a patient remains practically well, and his serum keeps negative, for several years, he has a substantial gain. Moreover, as Fournier pointed out, those patients who have been treated regularly with mercury, do not suffer with the late accidents of syphilis so frequently as those who have not taken this drug. Among the worst of these possible accidents are, of course, the lesions of cerebrospinal syphilis.

The serologic results from mercury have been studied by many, and the reports are somewhat at variance. It is claimed that the reaction of the blood can be made negative by thirty inunctions in 35 per cent. of cases; also that in early cases the blood becomes negative in two months with injections of the red iodide. Mercury by mouth is much less active. But many cases relapse to positive, showing that a negative reaction does not prove that the spirochæte is killed. On the other hand, many cases remain positive after injections of the salicylate.

Hazen, who gives these figures in detail, concludes that injections or inunctions give a negative reaction much sooner than does medication by the mouth, and that inunctions are about as good as injections.⁵

¹ Neurolog. Centralbl., 1910, XXXIX, 1170.

² Jr. A. M. A., Dec. 19, 1914, p. 2182.

³ See the present writer's article in Musser and Kelly's Practical Treatment, vol. iv, p. 913, where the subject is discussed at length, and whence some of the statements in the text are taken.

⁴ Hazen, Syphilis, p. 575.

⁵ Hazen, *op. cit.* pp. 576, 577.

As the case now stands, the writer, from a large neurological experience, advises that patients with cerebrospinal syphilis be given the benefit of treatment with mercury, preferably by inunction. The laboratory tests of the blood and spinal fluid should be made at frequent intervals, but these tests should not be the exclusive basis for either hope or despair. This treatment is empirical, but it has the support literally of centuries. As already said, it can be combined or alternated with treatment with arsphenamin. It is proper to say that fumigation with mercury still has its advocates.

Since the introduction of salvarsan by Ehrlich in 1909, an immense literature has grown up, for this preparation has unfortunately been advertised and exploited beyond anything ever known in the history of medicine. There has been little less than a popular craze; and, as in the case of all pandemics, it behooves the cautious observer to preserve a critical state of mind. The subject will be discussed here simply as it relates to the treatment of cerebrospinal syphilis. In this treatment with salvarsan, or its namesakes and pseudonyms, the tendency has been to draw hasty conclusions, and to ignore the gravest problems of pathology as well as the natural history of the disease. Claims of rapid improvement, or even cure, have been made in the case of diseases which show the most inveterate and destructive processes in the central nervous system; and in the presence of an organism which has shown its ability to survive in a latent state for many years. But to enter judgment *against* salvarsan at the present time might be as wrong as to decide *for* it, and in these pages the writer does not intend to dogmatize one way or the other. The drug has been injured by its friends, notably in the case of tabes and paresis, but its potency in meningo-vascular syphilis seems to be assured. Whether it will prove to be the cure-all which some of its advocates have predicted, is still, at least, an open question.

Salvarsan contains 31.5 per cent. of arsenic. It is kept in vacuum tubes to prevent oxidation, and is marketed in various-sized ampoules containing from 0.1 to 0.6 gm. It has an acid reaction on its solution in water. As a rule, no symptoms follow the injection into the veins, but exceptions occur, and fatalities have resulted. Neosalvarsan is a milder preparation, three parts being equivalent to two parts of salvarsan. The dose is 0.3 to 0.9 gm. It is given almost exclusively by the intravenous method, as it is even more irritating and more prone to cause sloughing than salvarsan, when injected under the skin or into the muscles. It has largely superseded the mother product, salvarsan. The American product called arsphenamin, is now largely used in this country. The drug, under whatever name, has a complex chemical formula,¹ and the chemical processes described to explain its action in the body of the spirochæte are still more complex and formidable.

The custom now is to give arsphenamin by injections into the veins. The advantages of this method are exactness of dose, less pain and local

¹ Lloyd, Treatment of Paresis, in Musser and Kelly's Pract. Treat., vol. iv, p. 915.

reaction, prompt distribution of the drug, and, as is claimed, better results. A careful technic is to be observed; the remedy is to be in an alkaline solution; care is to be observed to exclude air-bubbles; and it should not be given to patients with Bright's disease, diabetes, advanced arteriosclerosis or cachexias, or in the advanced stages of tabes or paresis. Some of the latter salutary rules are not advocated and practised by all.

After the injection, the patient should be kept quiet and under observation, preferably in bed, for about twenty-four hours. There is occasionally a constitutional reaction, such as fever and headache.

But all is not fair-sailing in the use of this powerful drug, and its risks ought not to be ignored. A good many deaths have been caused by arsphenamin. In fatal cases, death may be preceded by nausea, vomiting, diarrhœa, dyspnœa, œdema, cyanosis, and coma. Some of these symptoms appear in non-fatal cases. A particularly unpleasant, and sometimes dangerous, complication is an exfoliative dermatitis, and this may be accompanied with nephritis and peripheral neuritis.¹ Thus in a young man with cerebral syphilis, which had caused hemiplegic attacks and paralysis of the sixth nerve, in the writer's wards in the Philadelphia General Hospital, arsenical dermatitis with nephritis was caused by the second or third injection. The patient was very ill, but recovered; but his brain syphilis was in no wise controlled. A grave question has arisen whether powerful arsenical preparations may not injure the optic and the auditory nerves. Atoxyl had proved injurious to the optic nerves, when used by Koch for African sleeping sickness, and suspicions were early roused of similar action by arsphenamin.² The writer has seen cases of nerve deafness coming on very quickly after a few doses of arsphenamin in the early secondary stage.³ The tendency is to deny these things, or to explain them away; but, in the writer's experience, nerve deafness has happened oftener since, than before, the use of arsphenamin. The question is still an open one. Neuro-recidivus, or the provocative action of a dose of arsphenamin in lighting up cerebrospinal syphilis, is also a subject for serious consideration. Beeson has called attention to the abolition of the Achilles reflexes as a danger signal in the use of arsphenamin. It may indicate a beginning peripheral neuritis due to arsenic.

Death has been held to be due sometimes to a "Herxheimer reaction," by which is meant that an exaggeration of the symptoms, rather than an amelioration of them, is caused by the drug, and this in turn is explained as due to a "liberation of the endotoxins from the treponemata killed by the arsphenamin."⁴ Hazen believes that the majority of these deaths are due to hæmorrhagic encephalitis or myelitis; and says that it has been usual to find syphilitic lesions in the central nervous system post-mortem. These facts are of special significance to the neurologist; they seem to indicate that

¹ Beeson, Polyneuritis plus Dermatitis Exfoliativa following neoarsphenamin, Arch. Derm. & Syph., Sept. 1920.

² Nonne, Syphilis of the Nervous System, p. 380.

³ Lloyd, Syphilis of the Eighth Nerve., Arch. Neurol. & Psych., May 1921, p. 572..

⁴ Hazen, Syphilis, p. 613.

moderate, even small, doses should be used at first in cases of cerebrospinal syphilis in order to kill off the organisms gradually.

Although the spirochætes may invade the central nervous system at an early stage, as already explained, it is not usual for the neurologist to see patients at this stage, for the simple reason that in the great majority of cases the clinical manifestations of nervous syphilis do not appear until later, or they are so slight at first as to be overlooked. In very exceptional cases, as already said, fulminating attacks of cerebrospinal syphilis have occurred early in the secondary stage; and involvement of cranial nerves, such as the second or eighth, may occur in a few months; but as a rule, the patient has already received treatment, either with mercury or arsenic, before he falls into the hands of the neurologist. In fact, the occurrence of neuro-syphilis, sometimes long after treatment in the primary and secondary stages by the syphilologist, repeatedly raises the question in the mind of the neurologist, why these things should be, if arsphenamin is such a sovereign remedy. The answer usually given is that the treatment had not been sufficiently active. The only thing for the neurologist to do is to begin all over. But it is not unnatural that he should become cautious in time about accepting the reports of the brilliant results so often proclaimed by others. Involvement of the cerebrospinal system remains today the great problem presented by syphilis.

It is usual to find the Wassermann test of the blood or cerebrospinal fluid, or both, positive, and with some degree of lymphocytosis; and treatment is to be commenced at once even if, as in rare cases, the laboratory confirmation is lacking. It is best to begin with a small or moderate dose, 0.4 gm., not too often repeated, about five or six doses at intervals of one or two weeks, watching the clinical results and the effects on the blood and spinal fluid. In very acute early cases, as of meningocerebritis with involvement of cranial nerves, this treatment, in the writer's experience, often gives good results, but in old-standing cases the results are not always either prompt or complete. This, of course, is to be expected, for in long-standing cases injury may have been done to the nervous tissue that is beyond repair. Hence it is not wise to make promises of cure. Sometimes, however, in tertiary cases in which the general disease has long been in abeyance, the symptoms of cerebral or myelitic syphilis may appear rather abruptly or acutely, as in the case of a man who had had a primary sore fourteen years previously, and began at this late date rather suddenly to have deafness, dizziness, optic neuritis and paralysis of the seventh nerve. In such cases arsphenamin does well. Also, a certain type of cranial syphilis is seen, in which there is a slight dementia, along with a psychosis not unlike what is seen in the early stage of paresis; in such cases a favorable prognosis may be made, if prompt treatment is given, especially with mercurial inunctions; and these are probably the kind of cases which are reported as cures in paresis. Nonne cautions against the active specific treatment of patients just after apoplectiform attacks due to syphilis; in

this connection what is written above about the Herxheimer reaction may be recalled. But in patients who have a tendency to repeated hemiplegic attacks, coming and going, possibly with paralysis of one or other cranial nerve, such as the third or sixth, the likelihood is that there is a more or less wide-spread vascular syphilis at the base, and treatment, either with arsenic or mercury, or both, may be disappointing. For some reason the treatment of syphilis of the spinal cord, in the writer's experience, does not give as good results as early frank cerebral cases. Possibly this is because of the much smaller area of the cord, and its risk of being the worse injured in its limited transverse area by vascular lesions. If patients with meningomyelitis are seen very early, when the symptoms of irritation of the membranes and nerve-roots are still predominant, and the substance of the cord has not yet suffered, they should be given very active treatment, for there is no time to lose, but mercurial inunctions should be used as well as arsphenamin. Unfortunately such patients are too often neglected, because the disease is not recognized in its early stage. Suspicious neuralgic pains, slight dysuria, alterations in the deep reflexes, and limited areas of anaesthesia, easily overlooked, are the earliest symptoms in such cases. Thus in one case a nerve-root anaesthesia, limited to an area on one side of the trunk, led to a correct early diagnosis. In cerebral syphilis the earliest nerve-roots to be affected may be those of the auditory nerve, possibly because of the passage of this nerve through a bony canal. In such cases deafness, with tinnitus and vertigo, may progress rapidly, until in a short time the loss of hearing is complete and incurable. G. W. Mackenzie of Philadelphia holds that this disaster to the eighth nerve is evidence that the treatment had not been active enough, and is not an instance of neuro-recidivus provoked by arsphenamin, or much less a case of poisoning of that nerve with arsenic, as some have hinted.¹ If Mackenzie's view is correct, the thing to do is to push treatment, although this requires some boldness in the practitioner, who may suspect, or fear, that the treatment itself has caused the bad results.² The present writer prefers not to continue the use of arsenic in such a grave crisis. Optic atrophy has been considered by some to be a contraindication to the use of arsphenamin. According to L. S. Greene, there still is diversity of opinion about its use in cases of involvement of the retina and optic nerve.³ Many cases of optic neuritis and neuro-retinitis have followed its use, but, just as in the case of the eighth nerve, this complication seems to raise a question in the minds of some as to whether the drug ought not to be used even more vigorously.

Gennerich makes an interesting point about immunity. When the spirochaetes enter the system a defensive reaction is set up, shown by the florid eruption. If this is checked by only partially killing the spirochaetes, the patient is worse off than before. Patients with tabes and paresis often have no history of an acute secondary or florid stage; that is, they did not

¹Finger, of Vienna, according to Nonne, was the first to express this opinion. *Syph. of Nerv. Syst.*, p. 381.

²G. W. Mackenzie, *Syphilis of the Inner Ear and Eighth Nerve*, *Am. Jr. Syph.*, Jan.-Apr. 1918.

³L. S. Greene, *Chap. on Syph. of Eye*, in *Hazen's Syph.*, p. 400.

develop a good defense.¹ This idea of Gennerich tends to show what occult problems are presented in the treatment of syphilis.

Subarachnoid injections have been much used. In 1912 Swift and Ellis proposed their method of injecting arsphenaminized serum, which consists in the use of a serum obtained from the patient himself after he has had an intravenous injection of arsphenamin. Ogilvie's method is to add a small amount of arsphenamin directly to human serum. He cautioned against using more than 1 mg., and Fordyce warns against using more than 0.5 mg. and has even used smaller doses with advantage. This subarachnoid method has been used especially in tabes and paresis, but it is not necessarily limited to the treatment of those diseases.² Controversy has arisen about its utility, and Sachs and others have held that it offers no advantages.³ Gilpin and Early proposed drainage of the subarachnoid space by lumbar puncture when arsenic or mercury is given, their idea being that this drainage promotes the passage of such substances from the blood into the cerebrospinal fluid. Dercum thinks that spinal medication is unscientific, and believes the benefits obtained by the Swift-Ellis and allied methods are due to the spinal drainage which is made prior to the injection.⁴ A good deal of speculative physiology has entered into the discussion of some of these problems, but the writer is not convinced that the subarachnoid method has proved its worth in locomotor ataxia or general paresis. Fordyce, from a large experience, is a strong advocate of intraspinal treatment for certain types of neurosyphilis which fail to respond to other methods.⁵ L. Thompson believes that all patients with syphilis of the nervous system should have intraspinal injections.⁶

It has not been proved that either tabes or paresis can be cured by arsphenamin, however given, but not a few observers claim that improvement is possible. The earlier the treatment is begun, the better of course will be the results. The facts have long been known that tabetic patients are susceptible to suggestion; that temporary improvement has followed on the use of various novel so-called "cures"; and that remissions occur naturally in paresis that may give rise to false hopes. These facts are not always given due weight in estimating the effects of drugs on these patients. It is not to be overlooked that harm has been done in some cases, as Nonne pointed out. He wrote in his second edition⁷ that arsphenamin is no more a cure for paresis than mercury and iodide; and time has not changed this verdict. The writer believes that the same is true of tabes.

No attempt will be made here to interpret the value of the laboratory findings as an index of treatment. It is the custom probably in most hospitals to accept these findings at their face value, and to let it go at that. Noguchi is quoted as saying that serologic reports after treatment are very difficult to interpret; and Hazen says merely that if the infection

¹ See review of Gennerich's work in *Arch. Neur. and Psych.*, Oct. 1921, p. 462.

² J. H. Lloyd, *Treatment of Paresis*, in *Musser and Kelly's Practical Treatment*, vol. iv, p. 913, *et. seq.*

³ B. Sachs, *Arch. Neurol. and Psychiatry*, March, 1919.

⁴ F. X. Dercum, *Arch. Neurol. and Psych.*, March, 1920.

⁵ J. A. Fordyce, *Am. Jr. Syphilis*, July, 1919.

⁶ L. Thompson, *Syphilis*, p. 354.

has not existed for more than two months, the reaction will usually become negative after two intravenous injections; but in cases dating back for years more injections will be needed.¹ The majority of cases of syphilis of the nervous system are not early cases when they first fall under the care of the neurologist; moreover, the central nervous system, as already said, may have been invaded at an early stage, and long before there were any clinical evidences of it, or, at least, before they were detected. Usually the four reactions, some or all, are present when the patient first comes under observation; but if the clinical examination is convincing, negative findings in the laboratory should not be hastily accepted, but should be compared with the results of second and even third trials. It is more difficult to secure negative results with arsphenamin in long-standing cases, as of tabes and paresis, than in early cases of cerebrospinal lues; but in some very advanced cases the reactions are not positive. The only possible "rule" is to go by results; to make frequent tests and to compare the reactions with the clinical results of treatment.²

But some precautions are necessary, for, in the frantic attempt to secure a negative reaction, harm may be done by overdosing the patient with a very powerful drug. This error is especially to be avoided in cases of tabes and paresis. But even in other cases the possible ill effects of arsenic on the cranial and peripheral nerves should never be ignored. This is discussed above.

Hazen has wisely said that one of the most difficult things to know about syphilis is to know when the patient is cured.³ This is particularly true in the case of neurosyphilis. He would be a rash man who claimed that his patient was cured because he had a negative Wassermann reaction after a course of treatment. Criteria do not yet exist for the determination of this subject, and the neurologist, especially, is never justified in pronouncing the subject closed in any case whatever. The rule laid down by Loyd Thompson, that a patient can be pronounced cured in two years if he shows a constant negative spinal fluid and blood "without any increase in symptoms," is somewhat arbitrary.⁴ Why two years?

Warthin says that a negative Wassermann reaction does not indicate absence of syphilitic infection, nor can repeated negative reactions. He has repeatedly found the active lesions of syphilis, with spirochaetes present, when the reactions were negative. In cerebrospinal syphilis the reaction in the blood is frequently negative, when that of the spinal fluid is positive. In eight patients whom he says he saw "dying of salvarsan poisoning," the spirochaetes were present, and in two of these patients they were "swarming." He found the active lesions of syphilis in various organs in the autopsies on patients who had been treated and regarded as cured, and in cases of negative Wassermann reaction.⁵ This rather gloomy picture is

¹ Hazen, Syphilis, pp. 615, 616.

² J. E. Moore, The Cerebrospinal Fluid in Treated Syphilis, Journ. A. M. Assn., March 19, 1921, p. 769.

³ H. Hazen, Syphilis, p. 633.

⁴ L. Thompson, Syphilis, p. 355.

⁵ A. S. Warthin, Am. Jr. Syph., 1918, 11, 425.

taken from the observation of facts, and it presents a contrast with the optimistic views now so much in fashion.

Silver arsphenamin has recently been recommended by Walson.¹ It contains 22.4 per cent. of arsenic and 14.1 per cent. of silver. Dreyfus and others have claimed good results from it in nervous syphilis. Walson claims that it is the strongest spirochæticide, as well as the least toxic of all arseno-benzol preparations. He also says that mercury should be given at the same time. Silver arsphenamin has been tried extensively at the Base Hospital of the American Forces at Coblenz, Germany. It is said that argyria has been caused by this drug.

The treatment of cerebrospinal syphilis with the iodides has fallen somewhat into disuse, especially since the introduction of arsphenamin. They are probably little used now in the early forms, but in old cases of so-called gummatous meningitis they are to be given a trial. Iodine has not been shown to have power to kill the spirochæte, so it has no claims to be called a specific; neither does it influence the Wassermann reaction. Experimental work, such as that done by Nichols on rabbits and by Neisser on monkeys, seems to show that in these lower animals it is not without effect,² but in man, iodine is not considered curative. The prejudice in its favor in the so-called mixed treatment with bichloride of mercury will probably continue to lead to its use by some in that way. There is a widespread belief, however, that in the late stages of specific meningitis the iodides are effective; but in the case of large gummata in the brain they usually prove to be useless. It is better to use them alone, that is, uncombined with mercury, as this method admits of a gradually increasing dose; but the immense doses, once in favor, are not to be recommended.

As said elsewhere, if a large gumma forms in a favorable location, it can be removed by surgery, as recommended by Horsley and others; but specific medication with arsenic or mercury, or treatment with the iodides, should be continued, because such a tumor may be only a part of a widespread gummatous meningitis.

But, in the writer's experience, gumma of the brain is much rarer than the books would lead one to suppose. Warthin, already quoted, found the lesions of late or latent syphilis not gummatous, but tending to fibrosis. The process is one of lymphocyte and plasma-cell infiltration, with fibroplastic and angioplastic proliferation. In the brain there is proliferation of the neuroglia, especially in paresis.

Recently it has been proposed to treat paretics by inoculation with the plasmodium of malaria, and some trials of this method have been made, but it is too soon to set a value on this work.³

The various complications that occur in syphilis of the nervous system require symptomatic treatment. In meningomyelitis, bed sores and paralysis of the bladder are not uncommon. Avoidance of pressure is the

¹C. W. Walson, *Am. Jr. Med. Sci.*, March, 1921, p. 418.

²L. Thompson, *op. cit.*, p. 249.

³Wagner-Jauregg, *Journ. Nerv. and Ment. Dis.*, May, 1922. H. F. Delgado, *Ibid.*, May, 1922.

best preventive of the former. Irrigation is indicated if the bladder is infected, as it may be by the use of the catheter; but retention is not the rule in these cases, and the catheter should be avoided if possible. Tabetics may have to wear a rubber urinal.

The pains of tabes may be so severe as to indicate the use of morphia, but it is easy to induce the opium habit, and this should be avoided. The various coal-tar derivatives are not of much use. Resection of posterior nerve roots has been suggested in these cases, as well as in cases of myelitis in which irritative symptoms, such as pain and clonic spasms of the legs, are present; but this operation, in the writer's limited experience with it, has not been of much benefit, and it is attended with great risks.

Fränkel's methods of exercise for tabetic patients have been much lauded. They require time, persistence, and hope on the part of all concerned, and, as they are in no sense curative, they are likely to fall into disuse after a given trial.

The treatment of paretics consists largely in custodial care, and is a problem for the hospitals for the insane.

Massage, baths and electricity can do little good to a patient whose central nervous system is being destroyed by the spirochætes of syphilis. But careful attention should be given to the kidneys, heart, liver, stomach and bowels in all persons under treatment for any form of cerebrospinal lues.

The arthropathies of tabes do not, as a rule, call for treatment. They are chronic, painless and incurable; and are not the proper objects of surgery. Iron or leather braces are sometimes advised, but they are a source of embarrassment rather than help.

The treatment of congenital syphilis requires brief notice. If by "hereditary" is meant something that is transmitted through the germ-plasm, in the biological sense as now generally accepted by the followers of Weismann, it is probably safe to say that there is no such thing as "hereditary syphilis." In other words, the spirochæte can probably not be transmitted in either the ovum or spermatozoon; all congenital syphilis is, therefore, acquired syphilis. It is acquired *in utero*. But how it is acquired is still a subject of debate. There is not much reason to doubt that it can be acquired from the mother through the placenta, but transmission from the father direct is more difficult to understand, and is denied by many. The spirochætes are found in the testicles and semen, and syphilis has been transmitted to animals by injection of that fluid; but whether it can be transmitted by this fluid to the mother or the child has not, so far as the writer knows, been clearly demonstrated. These obscure problems have only an indirect bearing on treatment.¹

The attempt to treat nursing children through the medium of their mother's milk has not been successful. The syphilitic infant may be treated with either mercury or arsphenamin. Mercury may be administered by mouth or by inunction, but the latter method is preferable. According to

¹ Findlay, *Syphilis in Childhood*, p. 1, *et seq.* Hazen, *Syphilis*, p. 414. L. Thompson, *Syphilis*, p. 34.

Findlay, these children show great tolerance of the drug, and he has used inunctions for a year without causing a toxæmia. Arsphenamin may be given, according to Hazen, either by intravenous or intramuscular injection. Either the jugular or occipital vein is chosen, or the thigh or gluteal muscles. The dose is 0.025 gram for a child of nine pounds. This seems like heroic treatment, but it is recommended by good authorities. Older children should be treated in much the same way as adults with acquired syphilis of the nervous system.

XII. LETHARGIC ENCEPHALITIS.

The treatment for this disease thus far is largely symptomatic. Attempts have been made to discover a microörganism, with some claims of success, but no reliable serum has yet been forthcoming. The serum of convalescents, however, has been used. Rosenow suggests the use of an anti-encephalitis serum made from a strain of streptococci which he believes is the cause of encephalitis.¹

Netter, who has written much about the disease, recommends hexamethylenamine with a view of liberating formaldehyde in the spinal fluid. He also recommends intraspinal injections of serum from convalescents, and employs sialogogues, such as jaborandi and pilocarpine, because, in some cases, the parotid glands are enlarged and the inference is that the saliva contains the virus.² All these recommendations are based on theory. Regett tried lumbar puncture and subcutaneous injection of the patient's spinal fluid, and thought he had favorable results in a small number of cases.³ The lumbar puncture itself may have been beneficial.

Manson used the serum of convalescents intraspinally in two severe cases without benefit. He thinks it might be better to give the serum intravenously and to make spinal drainage at the same time.⁴

As no specific is known, the treatment is expectant. During the somnolent or stuporous stage the chief problems are to feed the patient and to secure proper nursing. Care must be taken in administering food that no portions pass into the larynx, for a bronchopneumonia is one of the risks. A fluid or semi-fluid diet is indicated.

In some cases vomiting and diarrhœa are noted. Small doses of calomel or saline laxatives may be given with advantage when the bowel functions are disordered; in fact, this method of elimination is not to be ignored.

The use of sedatives is not often indicated, and requires great judgment. In the somnolent stage they are certainly not to be given, even though, as in some cases, there is a form of delirium present. Restlessness, insomnia, and symptoms of meningeal irritation, such as stiffness of the muscles of the neck, are not usually to be combated with such drugs, for

¹ Journ. A. M. A., Aug. 5, 1922.

² Presse Med. Ap. 7, 1920, also Pract. Med. Ser., 1920, vol. viii, p. 80.

³ Pract. Med. Ser., vol. viii, 1920, p. 80.

⁴ M. Manson, Glasgow Med. Journ., July, 1921.

the tendency to depression is always marked. The writer has seen no cases in which he thought that any of them could be used with advantage or safety. It is too much the custom to resort to sedatives as routine practice in all sorts of meningeal and cerebral diseases. Warm baths are better, and can be given to these patients with due care to avoid depressing effects if they are too warm or too long continued. Headache and mild delirium may be relieved sometimes with an ice-cap to the head. Hyoscine has been recommended.

Alcoholic stimulants are no more to be given than sedatives, unless, indeed, in very grave cases when the vital powers are failing. Even then, it is not clear that they are of any great advantage. Alcohol acts as a depressant, especially if given in very full doses. Strychnia will be sure to find favor with some because of its general, and often unfounded, reputation as a nerve tonic, but its beneficial action in this disease is not yet proven by a sufficiently wide experience.

The tendency of many of these patients is to recover, if they are let alone by the therapist and well nursed. The long duration of the disease renders the problem of treatment with drugs difficult, chiefly because of the anxieties of relatives, who feel that something should be done; but a very mild tonic, with proper feeding and nursing, is really all that many of them require.

Lumbar puncture, as a therapeutic means, is still on trial in this disease. If the fluid is under high pressure, it may occasionally be drawn off in small quantities with relief to some of the symptoms, such as headache, insomnia, and signs of meningeal irritation.

Some of the sequelæ of lethargic encephalitis are even worse than the disease itself; among them are myoclonic and choreiform disorders, and a condition remotely resembling paralysis agitans. Thus in a young man under the writer's care, this condition had lasted for more than a year, and looked as though it would remain incurable. Courtney has used conium successfully for some of these spasmodic affections, in doses of 3 to 15 drops of the fluid extract four times a day¹. Sodium cacodylate, hyoscine, mechano-therapy, fixation abscesses, and vaccines prepared from the corpus striatum of persons dead of the disease, have all been tried with varying success.² But the best hope of really helping these patients who suffer from the various debilitating effects of the disease, lies in a persistent tonic and roborant course, with good diet. The same may be said of those patients who suffer with mental disorders, not unlike dementia præcox, following lethargic encephalitis.

XIII. CEREBROSPINAL MENINGITIS.

The treatment for this disease resolves itself at the present moment almost entirely into the use of Flexner's serum. This treatment was elaborated after a long period of experimental work with the *diplococcus*

¹ J. W. Courtney, Boston M & S Jr. July, 29, 1920.

² Pract. Med. Series, 1920, vol. viii, pp. 70, 71.

intracellularis. The serum is injected directly into the subarachnoid space after the withdrawal of a certain amount of the cerebrospinal fluid. The amount withdrawn should be from 20 to 40 cc. according to the age and size of the patient, and the quantity of serum injected should be a little less. It is customary to give an injection every twenty-four hours for several days, watching the effects. Needless to say every precaution should be taken in doing this work, and the fluid should be injected slowly. Barker calls attention to the necessity of early and rapid diagnosis, so that the treatment may be begun at as early a stage as possible.¹ As soon as suspicion rests upon a case, a lumbar puncture is to be done and a small quantity of fluid withdrawn; if it is turbid, the antimeningitis serum is to be injected at once without waiting for the results of laboratory studies. Statistics seem to show that the later the treatment is begun the higher is the mortality. Thus in Flexner's earlier tables, of those receiving the serum before the third day, 25.3 per cent. died; fourth to seventh day, 27.8 per cent.; later than the seventh day, 42.1 per cent. But chronic cases, in which the serum had not been used in the acute stages, sometimes show benefit. On the whole, the mortality rates in this disease have been much lowered by the use of the serum. Herrick² describes an early stage of general septicæmia, which he thinks requires intravenous injections of the serum.

According to Dopter, the organisms of epidemic meningitis can be divided into five groups, one of which caused the parameningococcic infection which was observed during the Great War.³ This suggests that various serums may be required according to the variety of the infecting organism. Dopter recommends both intraspinal and intravenous injections, but Blackfan utters a caution about intravenous injections, because of the severe systemic reaction.⁴

Cushing and Sladen have injected serum directly into the ventricles, as it is well known that ventricular blocking occurs in these cases, causing an internal hydrocephalus, which would prevent serum by lumbar puncture from reaching these cavities. Recently Stetten and Roberts have recommended puncture of the corpus callosum as a means of drainage and relief of pressure.⁵ Puncture of the cisterna magna has also been recommended; also the injection of the serum into this space. These heroic surgical methods can only be safe in very skilful hands. Treatment with vaccines has also been tried; also the intravenous injection of glucose for relief of brain pressure, but these things are in the experimental stage.

Injection of oxygen or air into the subarachnoid space has been recommended by E. A. Sharp, who claims that good results are due, first, to the mechanical action, and second, to a therapeutic action of the gases on the meninges.⁶

¹ L. F. Barker, in Musser & Kelly's Pract. Treat., vol. iv, p. 296.

² Penna. Med. Journ., Oct., 1921.

³ Dopter, Lancet, June 21, 1919; also Pract. Med. Ser., vol. viii, 1919, p. 53.

⁴ K. Blackfan, Journ. A. M. A., Jan., 1921.

⁵ Stetten and Roberts, Jr. Amer. Med. Assn., Jan. 25, 1919.

⁶ E. A. Sharp, Trans. Am. Neurological Assn., 1921, p. 101.

The old-fashioned symptomatic treatment of cerebrospinal meningitis must necessarily be greatly modified in the presence of a curative serum. It is not desirable or necessary to be treating every symptom as it arises while we are waiting for the beneficial action of a specific. This applies especially to the use of sedative drugs, such as the opiates, the bromides and the various coal-tar products. It is better in most cases to avoid them entirely. As said elsewhere, the opiates, especially morphia, are the most efficacious for really controlling such symptoms as pain, insomnia, and restlessness; but their action is only temporary, they need to be frequently repeated, they cause disagreeable reactions, and mask other symptoms; and their use is not to be recommended unless in exceptional cases. This opinion, however, will not be received with favor by all, and an occasional hypodermic injection of morphia for the relief of pain will still have its advocates.

The various fever mixtures and antipyretics are probably useless; unless the former have some effect as diaphoretics or diuretics, but this advantage must be slight. Elimination by the bowel, however, is not unimportant, and mild laxatives should be given on occasion.

Warm baths have long been in good repute, and should be given. They tend to control the nervous symptoms and even to reduce fever, if not too warm. They are better than sedatives. An ice-cap to the head may relieve headache and insomnia. An ice-bag to the spine is a remedy for the rachialgia, and in some cases may act better than the warm bath.

Convulsions in children are best controlled with the warm bath. Bromides are also indicated, and chloral has been advised, even given by the rectum, if the convulsions are difficult to control. A few whiffs of ether might be better.

Vomiting calls for the use of cracked ice by the mouth; as it is of central, or cerebral, origin, it may be controlled with morphia under the skin, and this fact furnishes an additional argument in favor of the use of this drug.

The action of the kidneys is best promoted by the free drinking of water; this should be encouraged, for the elimination of toxins from the blood may thus be effected.

Alcoholic stimulants may be of use to support a weak, irregular and failing heart. Dunn, of Boston, recommends caffeine. Digitalis at such a time may be effective. Strychnia, because of the nerve-root irritation, is not to be given.

Hexamethylenamine is one of the newer remedies, and has been used on the theory that it liberates formaldehyde and thus acts as a disinfectant of the cerebrospinal fluid. Leeches, blisters and wet cups are the relics of a by-gone day.

As the meningococcus is believed to enter the body by way of the nasopharynx, means have been employed to disinfect this region. Sailer mentions dichloramin-T used as a spray; also phenol, iodine, formalin and various silver salts.¹ But there are very contradictory opinions about the value of this local treatment.

¹ J. Sailer, Penn. Med. Journ., Feb., 1920.

There are various sequelæ of cerebrospinal meningitis, but they are probably neither prevented nor cured by treatment with drugs. The best hope is that they will be prevented by the serum. Some cases pass into a chronic stage, and Barker speaks of a patient in this stage who was benefited by the serum. Deafness and residual palsies are among these sequelæ. If otitis media or mastoid disease supervenes, it should be treated as a surgical affair. Ophthalmic complications may occur, and conjunctivitis may be prevented or relieved by irrigation with a solution of boric acid. Bed sores are to be avoided, but if they occur they are to be treated by the approved methods of cleanliness, disinfection and removal of pressure. Iodide of potassium has been used in chronic cases with the view of promoting the absorption of exudates.

Drainage by lumbar puncture at frequent intervals has been tried and approved; it is part of the treatment with the serum, although in that procedure almost as much fluid is injected as is removed. Nevertheless, the fluid removed contains the meningococcus and its products, and benefit may thus be secured.

XIV. PNEUMOCOCCIC MENINGITIS.

This is not a common form of meningitis, and when it occurs it is usually as a complication of pneumonia or some infection of the nasal sinuses. The writer once saw it occur suddenly in a young man who was convalescent from pneumonia. This would seem to show that the virulence of the pneumococcus may persist longer than might have been supposed. In the delirium of pneumonia there is doubtless an intoxication of the cerebrum, whether the organism is present in the brain or not, and Musser and Hufford practised drainage by lumbar puncture for this delirium with apparent good results.¹ It has been suggested that lumbar puncture at such a time may not be without risk, for it is supposed to determine a tendency to an outbreak of meningitis, but proof of this is wanting.

When meningitis has occurred, drainage by lumbar puncture, with the free use of hexamethylenamine has been shown, according to Homans, to be a curative measure in some instances.²

The possibility of the successful treatment of this form of meningitis with a serum was early suggested. Dunn, in 1910, wrote that serum therapy and vaccine therapy offered some grounds for hope. He tried anti-pneumococcic serum by intradural injection, but without result.³ The subject is complicated by the announcement that there are several types of the pneumococcus, each requiring its own serum. Dochez says that early destruction of the microorganism in the blood prevents the occurrence of meningitis, but he does not discuss the serum therapy of this affection.⁴

¹ J. H. Musser, Jr., and H. K. Hufford, Jr. B. Am. Med. Assn., Apr. 28, 1917, p. 1231.

² J. Homans, in Musser and Kelly's Practical Treatment, vol. iii, p. 852.

³ C. H. Dunn, in Hare's Modern Treatment, vol. i, p. 703.

⁴ A. R. Dochez, in Musser & Kelly's Practical Treatment, vol. iv, p. 214.

He says that ethyl hydrocuprein had been given in great dilution, intraspinally, but at the time he wrote the number of such attempts was so small as not to warrant discussion.

The serum was used in the camps during the late war. W. Broadbent gave pneumococcic serum, by mouth, on an empty stomach, and claimed good results in a number of cases.¹

A. C. Brown reported good results from the use of a pneumococcus vaccine.²

Pneumococcic meningitis is a particularly dangerous form. Its symptomatic treatment is much the same as that described for other forms of meningitis, but experience proves that it is not controlled by drugs.

XV. STREPTOCOCCIC MENINGITIS.

The streptococcus is a pus-forming microörganism, and is responsible for some grave infections of the brain and its membranes. It is the organism which is most frequently found in otitis media and mastoid disease, and is thus the cause of purulent meningitis and brain abscess. The treatment for these is largely surgical and has been discussed elsewhere. The staphylococcus is also a pyogenic coccus, as are some others, such as the *bacillus pyocyaneus*, colon bacillus, gonococcus, *bacillus typhosus*, and doubtless others, whose life history has not yet been sufficiently studied. As just said, the problem of treatment is largely a surgical one when pus forms, but the questions of a serum therapy and of a vaccine are therapeutic and prophylactic.

A general septicæmia or pyæmia may be caused by the streptococcus or staphylococcus, and foci of infection occur, from which emboli are carried to various parts of the body. Hence, meningitis and brain abscess may be only a part of a more wide-spread infection, as when they arise from empyæma or endocarditis. Other organisms which cause a general infection, such as the so-called *bacillus influenzae* of Pfeiffer, may also give rise to a suppurative leptomeningitis.

An antistreptococcic serum is now in use, but its efficacy in cases of purulent meningitis may be questioned; at least, there is not enough literature on hand to permit the writer to form an opinion. Recently two French observers, Abadie and Laroche, have reported a case of meningitis due to the *bacillus pyocyaneus* in which they claim that they had good results from intraspinal injections of an autoserum.³ After two such injections of 3 cc. of the patient's own serum, he made a rapid recovery.

Milligan tried leucocyte extract in mastoid disease, with meningitis, but it did no good.⁴

Serum therapy has grown to be a large subject; and it is quite impos-

¹Brit. Med. Jr., Oct. 28, 1916.

²Lancet, Sept. 16, 1916.

³J. Abadie and G. Laroche, Presse, Med., Feb. 13, 1919, also Pract. Med. Ser., 1919, vol. viii, p. 60.

⁴Penna. Med. Journ., Aug, 1922, p. 795.

sible in its present state to estimate its positive or prospective value in the treatment of the various forms of meningitis, except only the form caused by the meningococcus. The same may be said of vaccine therapy.

XVI. TUBERCULOUS MENINGITIS.

This, also, is a very hopeless form of meningitis. Claims have been made of recovery in some cases, but in most of such cases an erroneous diagnosis is probably the true explanation of the recovery. An unfavorable prognosis is the rule. We are limited to a symptomatic treatment, and drugs at best can only be palliative, and are not always useful even in that way. There is apparently no serum or tuberculin that will control tuberculous meningitis, although it is proper to make a trial of tuberculin in any given case if the patient is seen in an early stage of the disease. The possible provocative action of tuberculin in lighting up a dormant tuberculosis must not be forgotten.

Claims of recovery in cases of this disease continue, however, to be made, and should be given credit for what they are worth. A recent writer, Harbitz, has reviewed the subject, and states that there are on record at least forty cases of recovery in which the diagnosis was confirmed by the finding of tubercle bacilli in the spinal fluid, and in five of them by the ophthalmoscopic demonstration of choroidal tubercles.¹ The value of repeated lumbar puncture is insisted on, and in some cases benefit was attributed to intraspinal injection of antimeningococcic serum. This serum is supposed to act favorably in two ways; first, by adding to the spinal fluid certain antibodies; and second, by introducing a foreign protein in the form of horse serum.

In a case of hypernephroma, with metastatic growths in the brain, in a very young child, the writer was once misled by laboratory reports of the finding of tubercle bacilli in the spinal fluid. It was, doubtless, a laboratory error, for the autopsy showed no signs of tuberculosis anywhere.

According to Otis, tuberculin maintains its place "to a greater or less degree" in the general treatment of tuberculosis.² But opinions about its value still differ, and he is only willing to say that it may do some good and, if cautiously employed, does no harm. He is not speaking, however, of tuberculous meningitis.

Drainage not only by lumbar puncture but also by tapping the ventricles has been recommended. The former may be tried, but the latter, in the writer's opinion, is a doubtful expedient, although he has had no experience with it. Frazier is of the opinion that subtemporal decompression does not offer any better promise than simple lumbar puncture.

The symptomatic treatment for tuberculous meningitis is similar to that already described for other forms. The warm bath, the ice-cap, and the moderate use of sedatives are called for. As the patients are usually

¹ Pract. Med. Ser., vol. viii, p. 50 in which Harbitz's article is abstracted, and from which the statement in the text is taken.

² E. O. Otis, in Musser and Kelly's Pract. Treat., vol. iv, p. 248.

children, and as a somnolent or stuporous state is not unusual, opiates are not often indicated, and should be used, if at all, with great caution. It is needless here to emphasize the importance of careful nursing and feeding. Counterirritation to the head or back of the neck has had its advocates in the past, but it is doubtful whether it can do more than add to the patient's discomfort. Good results have been claimed for iodoform inunctions, but this treatment seems never to have met with wide approval, and it is difficult to see how it could do what has been claimed for it.¹

XVII. DISEASES OF THE BRAIN-STEM AND CEREBELLUM.

By the brain-stem we mean the midbrain, pons and medulla, the first named including the cerebral peduncles. All the cranial nerves, excepting the first pair, arise from, or have their central connection with, the brain-stem. The cerebellum is also closely connected with it, and together they constitute the subtentorial region of the brain.

It is better to group all these structures together in discussing treatment, for they are subject to many of the same diseases and are anatomically so closely related that they sometimes suffer together. The symptoms of their various affections are described elsewhere. (Vol. II, pp. 728,733.)

Two kinds of disease especially are found in these structures, namely, tumors and syphilis. But the treatment of both of these has been so fully discussed already that it is not necessary to repeat here in detail. Tumors of the cerebellum and the cerebello-pontile angle are sometimes excised successfully, but tumors of the brain-stem are less easily reached and are so firmly imbedded in vital structures that they are inoperable, and are usually fatal in a short time. The question of operation is largely, but not entirely, a surgical one. The judgment of the neurologist is of importance in these cases. Extensive vivisections are sometimes undertaken, and this work should always be in the hands of an operator who has made a special study of brain surgery.

Syphilis of the brain-stem is not uncommon, and its treatment is the same as that described elsewhere for cerebrospinal syphilis. The interpeduncular space, the surface of the pons, and the cerebello-pontile angle are all favorite seats. Thus the third, fourth, fifth, sixth, seventh and eighth cranial nerves may be involved, according to the location of the lesion.

The third nerves, emerging in the interpeduncular space, are often caught in a syphilitic meningitis. The indication is for active antiluetic treatment. The syndrome, called nuclear ophthalmoplegia, in which the nuclei of the third, fourth and sixth nerves as well as their trunks are affected, is usually caused by syphilis; and if seen early, it may yield to mercury or arsenic, but not always, for this affection may be slowly progressive and incurable. Syphilis of the pons may be determined by a location of the

¹ H. Mowat, *Lancet*, Jan. 7, 1911.

disease in the basilar artery or meninges, and deeper structures then suffer from vascular occlusion. The fifth, sixth and seventh nerves may be affected, and hemiplegia may result, of the crossed-type. If the midbrain is softened by a similar process, there is also a paralysis of the crossed-type with involvement of the third nerve.

A syphilitic meningitis in the cerebello-pontile angle may cause rapid and incurable loss of function in the eighth nerve. This may occur very acutely even in the early secondary stage, as the writer has shown, and may sometimes be associated with a paralysis of the seventh nerve, and with intense headache and high lymphocytosis.¹ It calls for prompt and energetic treatment, although an ugly question has been raised whether arsphenamin itself may not cause a destructive process in the eighth nerve. Inunctions of mercury may be substituted, if thought better.

Certain diseases, of obscure causation, may occur in the midbrain, pons and medulla. The affection called superior poliiencephalitis of Wernicke, is located in the midbrain and pons; and a similar very acute process is sometimes, though rarely, seen in the medulla. Alcohol, syphilis, and the infection of poliomyelitis have all been under suspicion, but the first named is probably not the cause. These affections are described elsewhere (Vol. II, pp. 728, 729). The treatment for them with drugs is not satisfactory, unless, indeed, they can be traced to syphilis, in which case antiluetic treatment should be tried.

Bulbar palsy is a chronic affection of the medulla oblongata, located especially in the nuclei of the nerves. In pathology it is similar to, and may be associated with, chronic anterior poliomyelitis or amyotrophic lateral sclerosis. Unfortunately, treatment with drugs is of no avail in this disease. A mere symptomatic treatment, directed to the support and comfort of the patient, is all that is practicable.

Abscess occurs in the cerebellum, but not often in the brain-stem. Meningitis, from various microorganisms, also occurs about these various structures, and may cause a blocking of the ventricles. The cisterna magna is sometimes infected, and can be drained by the aid of surgery. These subjects have been discussed elsewhere.

XVIII. THE CRANIAL NERVES.

Only a brief reference need be made to the treatment of these nerves, for much that is essential has already been written about it in the preceding pages, especially in the section on the treatment of cerebrospinal syphilis. Many of the affections of the cranial nerves are due to syphilis, and the process is primarily a syphilitic meningitis. This is true particularly of the second, third and eighth nerves; and to a less extent of the fifth, sixth and seventh.

Disease of the optic nerves is a large subject, and it is best to leave it to the ophthalmologists. These nerves suffer not only from syphilis, but also

¹J. Hendrie Lloyd, Syphilis of the Eighth Nerve, in *Arch. of Neur. and Psych.*, May, 1921.

from many other poisons, such as wood-alcohol, arsenic, lead, and tobacco; as well as from various dyscrasias, such as that caused by nephritis. They are also affected in the form of choked disks, or papillœdema, by meningitis, tumor and abscess of the brain.

The eighth nerves may be affected by syphilis, as explained in the preceding section. Other poisons also can injure them. Among these are the toxins of diphtheria and typhoid fever, and the metallic poisons, such as mercury and arsenic. Excepting in the case of syphilis the treatment of the eighth nerve is assigned to the otologists.

There is no special treatment with drugs that can be applied to affections of the other cranial nerves, except in the case of syphilitic basilar meningitis, which is usually the primary cause of their disorders. In some cases they are affected in other forms of meningitis, such as the tuberculous and cerebrospinal forms; and they may be pressed upon by brain tumors. The treatment for these various affections has been discussed under the appropriate headings. Trigeminal neuralgia and Bell's palsy are also reserved for special discussion.

XIX. DISEASES OF THE SPINAL CORD.

Syphilis.—So many of the diseases of the spinal cord are caused by syphilis, that a detailed discussion of treatment is not called for here. It has already been discussed under the heading of cerebrospinal syphilis. Among these diseases the chief ones are myelitis and meningomyelitis, primary lateral sclerosis, ataxic paraplegia and locomotor ataxia. The differences among these diseases are simply such as arise from differences in the location and extent of the syphilitic process. In tabes, it is customary to see something distinct from the others, because of some peculiarity in the action of the organism or its toxins; nevertheless, this disease is due to the spirochætes of syphilis, and from the standpoint of the therapist its chief claim to distinction is its incurability.

There are those who maintain that the patient with tabes can be helped, if he is treated with arsphenamin in the early stages of the disease. Mercurial injections and inunctions are also relied on, just as in the treatment for meningovascular syphilis. The combined method, indeed, is often used. In the writer's opinion, mercurial inunction is to be preferred to the intramuscular injection in any form of syphilis of the nervous system. It is usual in tabes to recommend that arsphenamin should be given intravenously in doses of from 0.3 to 0.6 gm. every ten days or two weeks. The effect of the treatment is to be gauged by lumbar puncture at intervals. After a period of treatment, say about two months, a tonic course with strychnia and iron is prescribed. Some observers insist that if this treatment by the intravenous method be not effective, the intraspinal method of Swift-Ellis or Ogilvie should be substituted, but, as said elsewhere, this subdural treatment has its vigorous opponents. The improvements noted after treatment with arsphenamin are relief of pain and

dysuria, a steadier gait, increased strength, and a better morale. On the other hand, the gastric crises, the Argyll-Robertson pupils, the lost knee-jerks, and the optic atrophy—in other words, the signs of organic changes—are not affected. The fact must not be ignored that in some cases distinct change for the worse has followed on treatment. It is impossible here to review all the literature *pro* and *con* on this subject of arsphenamin therapy in tabes. The present writer is not convinced that a remedy has been found. Remissions for long periods are a part of the natural history of tabes, just as of paresis. As L. Thompson says, many cases progress to a certain stage and then halt, even without treatment, and remain stationary for many years. All neurologists have seen many such cases. More time must elapse before we can claim that tabes can be either prevented or cured by arsenic.

In meningomyelitis, treated in an early stage, the prospect of relief or even cure is much better, but this will depend almost entirely on the exemption of the cord from organic changes. In some very acute cases the destruction within the cord, caused by the vascular occlusion, may advance rapidly. Thus in the case of a young man, under the writer's care, extensive softening and canalization occurred in six weeks. If treatment with arsphenamin or mercury, either or both, is to accomplish anything, it must be begun early, when the symptoms of irritation of the meninges and nerve-roots are still predominant. There is no treatment with any other drugs that will help these patients, and, in fact, there are few known causes of myelitis other than syphilis. All other treatment is symptomatic, and is directed largely to the preservation of strength, the relief of pain, the care of the bladder, and the prevention of bed sores. If the patient has not had syphilis, there is small hope of curing him.

The treatment of primary lateral sclerosis and ataxic paraplegia is not, as a rule, satisfactory, for these affections are largely "system" diseases within the substance of the cord, and, like tabes, they are exceedingly chronic and resistive to medication.

Tuberculous Meningitis.—Tuberculous infection of the membranes of the spinal cord is rare except as a complication of tuberculous spondylitis. The resulting paralysis, called Pott's paraplegia, is not due so much to pressure by the deformed spine as to an extension of the disease to the adjacent membranes, hence the motor tracts, because of their location in the cord, are more likely to be affected than the sensory. The treatment is surgical, and is usually with rest and support to the spine. Occasionally in a more generalized infection a tuberculoma forms in the membranes or substance of the cord, without involvement of the bones. Thus, in the case of a man with extensive tuberculosis of the retroperitoneal glands, under the writer's care, such a tumor grew in the lumbar enlargement. In such a case treatment with drugs is futile. If the tumor is located in the membranes it may be excised; but as the growth is only a local effect of a widespread infection, the prognosis in such a case is bad.

Pernicious Anæmia.—Pernicious anæmia may cause degenerative changes in the spinal cord, simulating especially tabes; but treatment with drugs is of no avail.

Poliomyelitis.—The treatment for poliomyelitis calls for only brief mention here. No specific treatment with a serum that is satisfactory has yet been devised for it. Its treatment is symptomatic and expectant, and the resulting paralysis and deformities are largely matters of surgical care. In the early acute stage, the patient is to be treated on the general plan, already outlined in these pages, for other acute diseases of the brain and cord. In sporadic cases, the disease is not always recognized in its early febrile stage, and the patient is sometimes regarded as only slightly ill; it is not until the paralysis has developed that the truth is realized. Febrifuges and mild anodynes and sedatives are the appropriate remedies. These can have no effect on the disease, but they may give some comfort to the patient. Warm baths are also indicated, but handling is often painful, especially in those cases in which meningeal symptoms are marked. Blood serum, taken from convalescent patients, has been tried; it has been injected into the subdural space in doses not exceeding 20 cc. Intravenous injections of immune serum are also advised by Wells.¹ It is only in the early stage apparently that benefit is obtained. Immune horse serum has been tried. This treatment is claimed by Nuzum and Willy to have given good results,² but the treatment has been much criticized. The paralysis, which is the chief relic of poliomyelitis, is to be treated with massage, electricity and time; and the weakness and deformities may need braces and tenotomies. Such agents as epinephrin, to meet respiratory failure, and hexamethylenamine, to disinfect the cerebrospinal fluid, may be used by those who have faith in them. Drainage by lumbar puncture is recommended.

Injury.—Injury to the spine is often accompanied with injury to the cord, and paraplegia of various degrees, according to the location of the injury, results. These cases are surgical, but the advice of the neurologist is usually sought. Operation for the removal of fragments of bone, or for displaced vertebræ, is often unsuccessful, for the simple reason that irreparable injury has been done to the cord at the time of accident. The writer has seen extensive injury to the cord, in the form of an hæmatomyelia, in a case in which there was no fracture or dislocation of the spine. A symptom of ominous import is the abolition of the deep reflexes. As pointed out by Bastian, this may indicate a transverse lesion. During the recent war some studies in cases of gunshot injuries tended to throw doubts on Bastian's law, but in the writer's experience in civil practice this law has held good. Thus in a case of pistol-shot injury to the cervical vertebræ the ball did not even penetrate the dura, yet a total paraplegia, with

¹C. W. Wells, Jr. A. M. A., Oct. 21, 1916.

²Jr. A. M. A., Oct. 13, 1917, p. 1247.

abolition of the knee-jerks, was present from the very beginning, and the patient was in no way relieved by a prompt laminectomy. The autopsy showed extensive softening of the cord.¹

Tumors.—The treatment for tumors of the spinal cord is entirely surgical. Gummata of the cord are rare, and are not easily, if at all, removed by antisyphilitic drugs; they are, therefore, to be classed with other growths as proper objects of surgical treatment. The problem of localization is one for the neurologist, and is to be solved according to the principles of spinal localization. Successful operation for spinal tumors is not uncommon, but it depends largely on the growth being meningeal, for a tumor within the substance of the cord is the cause of such destruction that it is usually inoperable, or, at least, if removed, it leaves permanent impairment. Treatment with drugs is of entirely secondary importance, and can be merely palliative, as for pain, bed-sores, and paralysis of the bladder. Nothing is more hopeless than the treatment of these growths with the ordinary measures. Everything depends on a prompt and correct diagnosis and the removal of the tumor at as early a stage as possible.

Progressive Muscular Atrophy.—In such chronic affections as progressive muscular atrophy and amyotrophic lateral sclerosis, the treatment is entirely symptomatic and palliative, and is along lines already laid down in these pages. Strychnia and electricity are of no use in these diseases.

Landry's Paralysis.—Under the term "Landry's Paralysis," or acute ascending paralysis, it is probable that different diseases have been described. The affection, whatever its cause and pathology, is located in the peripheral motor neurones, and its progress is usually rapid and its termination fatal. Not a few of these cases probably have been instances of poliomyelitis. The treatment is practically the same as for that disease. It is symptomatic, and directed especially to overcoming the tendency to rapid exhaustion. A sustaining treatment with stimulants and nerve tonics is therefore indicated. Strychnia, however, seems never to have been of use, and treatment with any form of serum or by lumbar puncture has never, so far as the writer knows, been used successfully. Death usually occurs by failure of the respiratory center in the medulla oblongata. Epinephrin has been used for this complication in poliomyelitis.

Syringomyelia.—Syringomyelia is due to a gliomatosis, which leads to the formation of a cavity within the spinal cord. It is described elsewhere (Vol. II, p. 774). It is chronic and incurable. Because of the loss of the sense of pain, which is one of its results, the patient is liable to accidents by burning, which should be guarded against; and if they occur, the burns should be treated most carefully, because of the tendency to trophic lesions. Arthropathies may occur, just as in tabes, but they are painless, and are not proper objects of surgical treatment. Drugs are of no avail in this disease.

¹ J. Hendrie Lloyd, *Total Transverse Lesions of the Spinal Cord*, N. Y. Med. Jour., July 31, 1915.

Friedreich's Disease.—Friedreich's ataxia is also a chronic and incurable disease of the spinal cord. It is often familial, several cases occurring in brothers and sisters (Vol. II, p. 773). An allied affection is known as Marie's cerebellar ataxia. These diseases are not controlled by drugs. Braces, mechanical treatment, and tenotomies are not indicated. The extreme ataxia renders the use of braces rather embarrassing than helpful.

The Caisson Disease.—This disease is caused by the action of the compressed air of caissons, as described elsewhere (Vol. II, p. 788). Softening of the spinal cord, especially in the dorsal region, has been found post-mortem. By some there is supposed to be a peripheral neuritis, but the history of the disease and the findings at autopsy show it to be an affection of the cord. The main thing is prophylaxis, and great care is taken now in large engineering works to prevent this accident. The workmen should emerge gradually into the outer air, and a rest station should be provided in which they can have time and opportunity to recover from the effects of their labor. Only men in good health and not too elderly should be employed, and the abuse of alcohol should be prevented. Many details are given by those in charge of these works, but these need not be repeated here. Among the former evils, which have probably been corrected now, were obliging the men to climb long ladders in coming up from their work, and the neglect of ventilation. Before the use of electric lights, the air in the caisson must have been vitiated very quickly. The symptomatic treatment is much the same as that for other organic lesions of the cord. Pain is sometimes very intense, and A. H. Smith, who had charge of the cases occurring at the building of the Brooklyn bridge, insisted that it should be relieved with morphia. He also tried ergot, which at that time was in some favor with neurologists; but it probably has little effect. It is claimed to control the capillary circulation, and Smith believed that it did good in doses of one drachm of the fluid extract. Jaminet, who treated these cases at the building of the St. Louis bridge, advised against the use of the hot bath; he saw paralysis come on while the patient was in, or just after he emerged from, the bath. Cold to the spine, and cups, have been beneficial. Foley believed that the immediate return of the patient into compressed air, as first suggested by Pol, acted as a specific, and Smith also was a strong advocate of this practice. He suggested the use of an air-chamber in which the air could be kept at the pressure desired, and in which the patient could be treated. This plan was adopted at the work on the Hudson river terminal. Bert recommended the inhalation of oxygen on the theory that nitrogen gas in the blood is the cause of the disease, and that this gas diffuses readily into oxygen. Epinephrin has been suggested, also on theoretical grounds. The resulting paralysis should be treated with rest, massage, electricity, and strychnia. But in cases in which the paralysis is spastic, the use of electricity and strychnia is not advised.¹

¹ XX Century Pract. of Med., vol. iii, p. 437, *et seq.* Also A. H. Smith in Allbutt's Syst. of Med., vol. viii, p. 38.

XX. MULTIPLE NEURITIS.

This disease may be caused by a variety of poisons, such as alcohol, lead, mercury, and arsenic; and by various infections, such as those of diphtheria, typhoid fever, and some others; also in leprosy and beri-beri; but in whatever form it occurs, the treatment for it is much the same.

The patients are usually so paralyzed in the acute forms that rest in bed is a necessity. In the alcoholic cases the general prostration may be extreme, the respiratory muscles may be involved, the action of the heart weakened, digestion impaired, and the skin leaky. In such cases the immediate object is to maintain the strength with good feeding; a liquid or semi-liquid diet is best, and nerve tonics, especially *nux vomica* or *strychnia*, are indicated; but alcohol in any form, even in the tinctures, is to be avoided. *Strychnia* may be given under the skin, if preferred, but the writer has not been able to convince himself that this method has any advantages. If *tachycardia* is present, it may indicate a dangerously weakened heart muscle, and sudden death may occur; *digitalis* in such cases does not act effectively, probably because the *vagus* nerve is implicated. An ice-bag to the precordia has been recommended, but it is not without risk. The writer once saw sudden death occur during its use. The danger of heart failure is particularly great in cases following diphtheria, and in some patients profoundly poisoned by alcohol. In these alcoholic patients pain is often severe in the legs and feet, especially on handling, but opiates should be avoided; the parts are to be wrapped in flannel or cotton, and pressure on the heels and malleoli is to be prevented. Artificial warmth may, or may not, be well borne, and liniments are not only not useful but irritating to the skin, and are injurious. More depends on time and careful nursing and feeding than on active treatment with drugs, for no drugs are specific in such cases. The bromides, salicylates and coal-tar preparations are of but little use, and in the case of very weak and depressed patients are contraindicated. The functions of the kidneys and bowels are to be regulated. Water is the best diuretic for old alcoholics, and mild laxatives to promote elimination are to be given.

In alcoholic cases the progress is sometimes very slow, and the patient passes into a chronic stage with paralysis and contractures of the arms and legs. Local treatment is then to be instituted, especially with massage and electricity. The former should be very gently done, especially as long as the nerves and muscles remain hypersensitive. Faradic contractility is abolished, and galvanism is to be preferred, but strong currents are to be avoided. When the muscles begin to react to faradism, this current is as good as the galvanic. Although electricity in some form is almost universally advised, its curative effect has probably been over-rated.

Contractures tend to retard recovery, and are sometimes difficult to overcome. Massage and passive movements are the best remedies for them, and, as the patient gains strength, he should be encouraged to exercise his limbs regularly.

The treatment of post-diphtheritic neuritis with antitoxin has been tried, with alleged good results. Large doses are recommended by some. Gödde gave 13,500 units to a man in whom the paralysis had persisted for two months, and who had had two doses during the acute stage. Improvement followed.¹

A caution against the use of opium or morphia to control pain is deemed necessary here. Any attempt to keep this symptom under complete control may simply lead, especially in the cases of alcoholics, to the substitution of one bad habit for another. A certain amount of pain is inevitable, and it can usually be alleviated with rest, and flannel to the parts.

Caffeine has been used for its alleged stimulating effects. In post-diphtheritic cases, in which there is much weakness of the heart, alcoholic stimulants in moderate doses should be used. In lead cases, elimination is supposed to be promoted by the use of sulphuric acid and the iodides.

XXI. THE SPINAL NERVES.

The individual spinal nerves may be inflamed or injured from various causes, and these have been described in detail elsewhere (Vol. II, pp. 795, 810). The treatment can best be discussed here under one heading, as it is practically the same for all of them. Groups of these nerves are sometimes involved, as in the case of the brachial plexus, and individual nerves, such as the median, musculospiral, ulnar, and sciatic, are not infrequently injured. Many cases of wounds of these and other nerves were observed and treated during the recent Great War, and a large literature, mostly surgical, has accumulated. Cervical ribs cause lesions of the brachial plexus, which usually demand surgical treatment, although Sargent thinks that operation is not required in all cases.²

Some forms of neuritis are of such a distinct clinical character that a separate note is made of them; such forms are trigeminal neuralgia, facial palsy, and sciatica, but much that is said under a general head applies also to them.

The medical treatment for neuritis is largely with rest, support, local applications and certain drugs.

An inflamed or injured nerve, it is needless to say, should be put at rest, and in not a few cases this implies rest also for the patient. Support by splint or sand-bag or pillows is to be secured, and the patient may thus require to be kept in bed.

Cold or warm applications may be useful, and it may be a matter of trial which are the better. The writer prefers cold, in the form of an ice-bag well wrapped in flannel so that the effect is moderated. This treatment is often good in sciatica. Cold, thus applied, is sedative, whereas heat may not be well borne. Nevertheless, the latter has had its advocates, particularly in the form of flannel wrung out of warm water. Liniments, espe-

¹Neurolog. Centralbl., Aug. 16, 1920. Also Pract. Med. Ser., vol. viii, 1920, p. 150.

²P. Sargent, Brain, July, 1921.

cially those containing opium and belladonna, will suggest themselves in the acute stages, but such an unpleasant substance as ichthyol, which was once in some repute, is not to be recommended.

Counterirritation can be applied in the form of blisters or the hot iron; these were probably more in favor formerly than at present. A blister applied over an acutely inflamed nerve is sometimes useful. The hot iron has been employed, especially in sciatica, and is particularly to be recommended in advanced and obstinate cases. Cupping is not so efficacious. Acupuncture is a very old remedy.

The name of the drugs that have been and can be used in neuritis and neuralgia is almost legion, and it is not desirable to give a catalogue of them here. At best they are necessary evils, and some of them may be greatly abused. The chief indication for their use is to relieve pain, and the physician is usually driven to the employment of analgesics. The best drug to relieve pain, and the only one that is fully reliable, is opium in some form, especially morphia by hypodermic injection. But the objections to morphia are so obvious, and have been so often stated in these pages, that it is not necessary to repeat them. The opium habit is easily formed by a patient who suffers from the pain of an irritable or inflamed nerve. The use of this drug is only allowable to meet urgent demands, as in very acute cases; but its frequent or continued use in obstinate or chronic cases, such as *tic douloureux* or sciatica, is wrong. Acetylsalicylic acid is given as a pain killer, but it is often disappointing, and the salicylates in any form are disturbing to the stomach. The coal-tar products are much in use, and may be tried. As it is necessary to give something, these are probably as unobjectionable as any, if used in moderation. Chloral and the bromides are not good analgesics. Among drugs which have now little more than historic interest may be mentioned atropine, aconite, conium and ergot. Cocaine is an efficient anodyne, and it has been used hypodermically, but the danger of inducing the habit is as great as in the case of morphia.

Constitutional treatment is called for if there is reason to believe that the patient is a victim of gout, rheumatism, malaria, syphilis, or lead. Any one of these may cause inflammation or irritation of nerves. In obscure cases, a careful search should be made with appropriate tests. Attention to the general health is necessary in all cases.

The use of electricity and massage is called for in the later stages, especially in cases in which paralysis and contractures remain. Galvanism is to be preferred; it is even claimed to have a soothing effect in case of pain; and in the case of paralysis, in which faradic contractility is abolished, it is the current of choice.

The intense burning pain which sometimes accompanies injuries of nerves, and which was named "causalgia" by Weir Mitchell, has been subdued with an injection of 60 per cent. alcohol directly into the nerve. Lewis and Gatewood report such cases observed in American soldiers during the recent war. The motor paralysis which is caused by the injection is only

temporary.¹ Alcoholic injections are also used for trigeminal neuralgia. The relief is said not to be permanent.

The surgical treatment of injured nerves was greatly advanced during the late war. The suturing of divided nerves was successful in many cases, and this whole subject may be said now to present a new aspect. It is, however, a surgical subject, and therefore cannot be discussed here in detail. Stopford, in a recent paper, reviews the results of end-to-end suturing in 271 cases.² Much apparently depends on the length of the interval between the date of injury and the date of operation. If the interval exceeds eighteen months, the prognosis is not so good as if it is shorter, but even after this long interval good results are sometimes obtained. Frazier and Silbert, from observations on a very large number of cases, conclude that the extensive experience gained during the war has given a death blow to Head's theories of sensation.³ The later treatment of these cases consists largely in the use of galvanism, massage and exercise. Faradism also may act beneficially by promoting the general exercise of the limb. It is impossible to see how any form of electricity can promote the uniting of the cut ends of a nerve; but something is gained by its use in encouraging the patient to use the limb as power returns. Galvanism is said to have the power to preserve, or to promote, muscular nutrition, because the galvanic contractility of a muscle is not abolished after a nerve injury as is the faradic; but this power is probably over-rated. As a test of returning power, however, galvanism has some value. The return of faradic contractility may be delayed until some time after the return of power. Injury to the brachial plexus may occur at birth, also in luxations of the shoulder joint; and T. T. Thomas of Philadelphia believes that the capsule of the joint is torn in some cases, and treats these cases by fixation.

XXII. TRIGEMINAL NEURALGIA.

The treatment for this affection has come to be almost exclusively surgical; therefore its discussion here need only be brief. Treatment with drugs has been proved by long experience to be quite ineffective, and amounts to little more than the use of powerful sedatives. Such treatment is only palliative and temporary, and is open to the objections which have already been urged in the case of other painful diseases.

Surgical treatment is mainly by two methods; the use of alcoholic injections, and the avulsion of the sensory root of the fifth nerve. According to Frazier, alcoholic injections have taken the place of operations on the periphery of the nerve. These injections can be given into the branch affected, such as the supra-orbital, infra-orbital, inferior dental, mental, or lingual nerve, or into the second or third division at its exit from the skull, or even into the Gasserian ganglion itself. The relief afforded may be prompt

¹ D. Lewis and W. Gatewood, *Jour. A. M. A.*, Jan. 3, 1920. Also J. A. Sicard, *Lancet*, Feb. 9, 1918.

² J. S. B. Stopford, *Brain*, May, 1920.

³ C. H. Frazier, and S. Silbert, *Surg. Gynec. & Obstet.*, Jan. 1920. Also *Pract. Med. Ser.*, vol. viii, p. 138.

and complete, but it is not, as a rule, permanent, although it may last as long as a year. Repeated injections are thus required, and each succeeding one may be less effective. Therefore a radical operation becomes necessary in time.

Excision of the Gasserian ganglion has been practised, but avulsion of the sensory root is now preferred by some surgeons. The chief risk is keratitis, with loss of sight, a complication which may also follow upon alcoholic injection of the ganglion. Much can be done to avoid this complication by careful subsequent treatment.¹

Cushing describes the various types of neuralgia of the face.² There are at least five of these which he thinks can be mistaken for *tic douloureux*; namely, those caused by involvement of the sphenopalatine ganglion from sinus infection; those which follow *herpes zoster*; the neuralgias accredited to the geniculate ganglion on the sensory root (chorda tympani) of the seventh nerve, which have been described by Ramsay Hunt; painful convulsive tic; and neuralgias from gross lesions, such as tumors. These evidently require to be treated according to their seat and pathology, but the only effective treatment for most of them is surgical. There are also minor neuralgias that arise from local causes, such as decayed teeth and infected sinuses, the treatment for which is special and obvious. In another paper Cushing claims that the results of treatment of trigeminal neuralgia with injections of alcohol into the branches affected are as enduring as from a peripheral neurectomy. But these injections are not without risks, and among the ill effects are oculomotor paralysis, fibrosis of the pterygoid muscles with locking of the jaws, corneal ulcers, and facial paralysis and ear troubles from accidental injection of the Eustachian tube. He condemns alcoholic injections into the Gasserian ganglion. But prolonged treatment of the nerve trunks is to be avoided in view of what can be accomplished now by avulsion of the sensory root.³

Injections of osmic acid, in a 2 per cent. aqueous solution into the nerves, as practised by J. B. Murphy, have been found to give relief, but their use seems to have been superseded by the use of injections of alcohol.

Syphilis has been known to cause a persistent neuralgia of the fifth nerve which closely simulates *tic douloureux*. It is probably caused by a meningitis about the sensory root of the nerve, and is usually associated with some other symptoms of intracranial syphilis. The history of the case and tests of the blood and cerebrospinal fluid will probably lead to a correct diagnosis; and the treatment should be with mercury and arsenic, as described elsewhere.

XXIII. PARALYSIS OF THE SEVENTH NERVE.

This affection, known as Bell's palsy, is usually caused by exposure to cold, and is described elsewhere (Vol. II, p. 748). It is probably due to a neuritis at the point of exit of the nerve from the skull, and even extending

¹ C. H. Frazier, Musser & Kelly's Pract. Treat., vol. iv, p. 870.

² H. Cushing, Amer. Jr. Med. Sci., Aug., 1920.

³ H. Cushing, Jour. A. M. A., Aug. 14, 1920. Also in Pract. Med. Ser., vol. viii, 1920, p. 126.

in some cases into the Fallopian aqueduct. As a rule, it is attended with but little pain, or even discomfort, except from the sense of disuse. The resulting paralysis is of the peripheral type; that is, all the muscles of the face and brow, supplied by the seventh nerve, as well as the *orbicularis palpebrarum*, are involved; and the paralyzed muscles soon lose their faradic contractility and show the reactions of degeneration. The affection is not very uncommon. It is sometimes alarming to the patient, but it is not dangerous, although very disfiguring and embarrassing, and is sometimes of long duration or even permanent. The prognosis as to rapid recovery should be guarded.

If the patient is seen early, a fly blister as large as a silver dollar should be applied either over the point of exit of the nerve, or just behind the ear (preferably in the former position), and it should be kept open and discharging for a week or two. During this time it is well to keep the patient indoors, even in bed, for too much care cannot be taken to overcome this affection in its earliest stage. The face should be protected from cold with flannel wraps.

Bell's palsy is probably not much influenced by treatment with drugs. It is a purely local affair, and drugs given internally cannot reach it. There is, however, a sort of conventional treatment which can be followed. Salicylate preparations are given three or four times a day in the belief or hope that they can influence a "rheumatic" condition. So long as they do not upset the stomach, they can be tried. Later in the course of the disease the iodides are usually substituted. These are about all the drugs that are given with the aim of influencing the pathological process in the nerve.

There is no indication for the use of anodyne or sedative drugs. As already said, pain is not present. The patient may complain of a sense of tenderness over the nerve trunk at its exit, but this is not severe enough to demand relief. Warmth applied to the face is soothing and should be used.

The later treatment of facial palsy is important, and may be tedious. Electricity should not be used in the acute stage, but later it will be demanded. The faradic contractility is abolished early, so this current is not employed. Galvanism is to be chosen, and care observed not to use a strong current, or to give painful shocks by reversing or interrupting it. One electrode only should be applied to the face, the other being placed on the chest or some other indifferent part of the body. As the reactions of degeneration are present, as a rule, these should be observed from time to time to note signs of recovery. The cathodal closure reaction, which is normally the strongest, may be weak, and the muscular tone lowered, so that a stronger current is needed than on the other side of the face, to cause responses. A good rule is to compare the reactions of the paralyzed muscles with those of the sound side. A current just strong enough to cause the muscles to respond is the proper one. This treatment may be given daily and for not longer than about ten minutes. The electrode is to be moved gently over all the affected muscles in turn.

In chronic cases massage is useful. The atrophied and flabby muscles are gently rubbed and kneaded. This treatment can, of course, be used in combination with electricity.

The usual rules for keeping up the general health are to be observed. Strychnia is a favorite remedy and should be given. Nothing probably is gained by giving it under the skin, and it should not be used in that way about the face.

The eye needs some attention because of the paralysis of the orbicular muscle. The inability of the patient to close the eye and to wink, allows dust and foreign bodies to enter and remain, irritating the conjunctiva. This can be, in a great measure, prevented or relieved by cleansing eye-washes.

In cases in which the paralysis is permanent, some mechanical devices have been suggested, but they are at least unsightly and not always acceptable. Yawger, however, has advised support by adhesive plasters during the period of active treatment, and this suggestion is of value. They are so adjusted as to support the sagging muscles, and they may relieve some of the distress caused by the deformity, and tend to promote restoration of tone.¹

Paralysis of the facial nerve may be caused also by otitis media and by stab wounds and other external injuries, such as the pressure of the obstetric forceps, and surgical operations about the head. Patrick has seen facial diplegia in multiple neuritis, but this is extremely rare. It has also been reported in tabes, but this also is rare. In syphilitic basilar meningitis, invading the cerebello-pontile angle, unilateral or bilateral facial palsy is sometimes seen along with involvement of the eighth nerve, as the writer has described elsewhere in these pages. The treatment and prognosis in these various cases depend upon the cause. Otitis media which has caused such necrosis as to invade the Fallopian aqueduct, requires the utmost skill of the otologist. In case of trauma, especially if the nerve is divided, the surgeon must assume charge. Suturing of the nerve might be performed. In incurable cases following otitis media, anastomosis with the hypoglossal or spinal-accessory nerve is recommended.

XXIV. SCIATICA.

This affection is usually described as an inflammation of the sciatic nerve. Its cause and pathology remain obscure. Recently it has been ascribed by Dejerine and others to a radiculitis, or inflammation of the sacral roots; and this is supposed to be located at or within the points of exit of these roots from the spine. It is also claimed to be due to disease or injury of the lumbo-sacral or sacro-iliac articulation. Observations made on the nerve itself indicate that, in some cases at least, there is a neuritis of the trunk. In one case observed by the writer, in a man who died of an intercurrent pneumonia while suffering from an acute sciatica, the upper

¹N. S. Yawger, Arch. Neurol. & Psych., Dec., 1920.

part of the nerve was found swollen and inflamed. There seems to be no sufficient reason to doubt that this is the true pathology in many cases. Syphilis is not the usual cause, but syphilitic infection of the sacral roots is a possibility which should not be ignored.

Sciatica may be simulated by gross lesions within the pelvis, such as tumors of the ovary, and malignant growths of the uterus or rectum. A careful pelvic examination by a surgeon or gynæcologist should be made in all cases. The writer once saw a case in which a small ovarian cyst caused symptoms which had been mistaken for those of sciatica; also another case in which a malignant growth near the sacro-iliac joint had led to a similar error.

The best treatment for sciatica is by immobilization of the limb. Weir Mitchell advised that the whole limb should be carefully bandaged and fixed on a splint. In some cases sand-bags may be preferred, especially as they admit more readily of local applications. This fixation secures absolute rest of muscles and nerve, and tends to diminish pain. It is especially indicated in the early stages.

The application of cold in the form of a long ice-bag, well wrapped in flannel, is also beneficial and is generally to be preferred to heat. It can be applied while the leg is kept in fixation. Blisters have often been used, but cold is better.

Various drugs have been used, but the preference today is for the salicylates. Some writers advise very large doses, but these are likely to disagree with the stomach, and the claim that they are curative is not sustained by experience in many cases. Treatment with drugs, in fact, just as in other forms of neuritis, is usually disappointing. The iodides are not potent.

Anodynes are to be given with great care. The demand for them may be urgent on the part of some patients, but the objections are obvious. They are, of course, not curative, they need to be frequently repeated, they are depressing, they disturb the normal functions and they may lead to the formation of the drug habit. Gowers recommended the injection of cocaine deep in the tissues of the thigh. As said elsewhere, morphia, while efficacious for the relief of pain, is a dangerous drug in all forms of obstinate neuralgia. The coal-tar products, while less reliable, should be used instead of opiates; but the treatment with rest, fixation, and cold will often render the use of the analgesics unnecessary.

The treatment of sciatica with the hot iron is very ancient, and is said to have been employed by Albucasis as long ago as 1106. It has been held in high favor in very recent times, but today it is probably not so much used. The writer has seen it act beneficially in very obstinate cases, and does not hesitate to recommend it. In one case, which had lasted for more than a year and had resisted much and varied treatment, the hot iron brought a cure. It was applied in four places over the course of the nerve, and deep burns, about one inch in diameter, were made. The Paquelin cautery was employed.¹ But Mitchell, who used the hot iron, prescribed very light touches frequently repeated.

¹ J. Hendrie Lloyd, *Twentieth Century Pract.*, vol. iii, p. 345, for a history of treatment.

Nerve stretching, which was first performed by Billroth in 1869, was in high repute at one time. As usually done, the operation consisted in exposing the nerve and elevating it on a blunt hook, stretching and manipulating it, and breaking up adhesions. The stretching was considered the essential thing, but the other manipulations were probably just as important. It has been claimed that the nerve can be stretched by forcible flexion of the thigh, but this is doubtful.

This operation of exposing the nerve for direct treatment has suggested the opening of the nerve sheath for draining. The writer has had this done in two chronic cases, with apparent benefit, but not with prompt cure. In these cases no changes in the nerve were visible.¹

Luria in 1884 advised the hypodermic injection of nitrate of silver. The object was to secure a local phlegmon which should act as a counterirritant. This treatment, like the acupuncture as done by the Chinese, has now only historic interest. But acupuncture, which is very ancient, and which may in some cases have really secured the penetration of the nerve sheath, may in a sense be considered as the precursor of the treatment by injections, which is now in vogue.

Alcoholic injections for trigeminal neuralgia are much relied on at present, and there seems to be no reason why they should not act as beneficially in sciatica. To give them accurately would probably require the exposure of the nerve trunk, as referred to above, although methods of injecting the nerve by using simply a long needle through the skin and tissues are now described. Injection into the epidural space in the lower part of the spine may be done without a formidable surgical operation, but merely with a long needle. This plan is described by Strauss, who advocates the injection of physiologic salt solution, as recommended by Cathelin, to which he adds a small quantity of novocaine and epinephrin. He also injects this solution in the neighborhood of the nerve.² Claims are made that this treatment shortens the duration of sciatica from weeks and months to days. If this is so, nothing more need be said about the treatment of this painful disease.

In case of injury to the lumbo-sacral or sacro-iliac articulation the treatment is surgical, and should be conducted by the orthopædist.³

XXV. CHOREA.

There are two forms of this disease; the ordinary form seen in childhood, or Sydenham's chorea, and the adult form. It sometimes occurs also as a complication of pregnancy. Some affections which are similar but not identical, are the electric chorea, and Dubini's chorea; and finally, certain forms of hysteria major are misnamed for this disease, but should not be included in the true choreas. The disease is described elsewhere (Vol. II, p. 811).

¹ Philadelphia Hospital Reports, 1916, vol. x, p. 48.

² I. Strauss, Journ. A.M.A., Dec. 15, 1917.

³ E. W. Fiske, Penna. Med. Jour., June, 1921, p 638.

Chorea usually occurs in childhood. Its cause is unknown. An infection of some kind has been suspected, but not demonstrated. The disease sometimes follows rheumatism or scarlet fever, but as there is no known cause, there is no specific treatment.

In very acute cases the movements are usually active and even violent, and the patient's general health not infrequently suffers. Rest in bed is indicated, and the child should have perfect quiet, which can only be secured by isolation. This rest is more important than drugs, and sometimes acts promptly to promote cure. The idea held by some parents that the disease, especially in a mild form, is not a very serious one, and that the child can even go to school, is erroneous. All cases, even the mildest, demand careful attention, and even in the mildest case the child should have the rest treatment. If this wise rule is ignored, the disease may go on into a chronic stage, and in that case it will eventually require this treatment.

The favorite drug for chorea is arsenic, and it has doubtless secured an undeserved reputation. Nevertheless, it should be tried for what it is worth. It is to be given in the form of Fowler's solution, and the custom is to begin with a small dose, three drops three times a day, and to increase the dose by one drop three times daily until about nine drops are given thrice daily. This dose should not be exceeded. Arsenic may cause a toxæmia, sometimes rather abruptly, and its effects should be carefully watched. Nausea, vomiting, and puffiness under the eyes are among these signs, and occasionally some irritation of the kidneys. But its most disastrous effect is a multiple neuritis, which is worse than the chorea. Not a few cases have been reported in which this accident was caused by overdosing children with this drug. Arsphenamin has been suggested for chorea, but on what grounds is not clear, unless merely that it is a form of arsenic.

Some experimental therapeutics has been tried in chorea. Pearce Bailey used lumbar puncture in violent cases, and found that when the cerebrospinal fluid was under pressure, this method diminished the violence of the movements. Intraspinal injections of magnesium sulphate, as suggested by Marinesco, have given good results, according to some observers. If necessary, a second or even third injection is given. But there seems to be no very good reason for this heroic treatment in the average case, for chorea minor tends to recovery about as well without as with it. It might be reserved for severe cases, which had resisted other kinds of treatment. The intraspinal injection of horse serum has also been tried. Porter used the antimeningococcic serum, which is said to be innocuous to children. This treatment is apparently based on the theory that this serum increases the permeability of the choroid plexus, and thus allows antibodies to pass into the cerebrospinal fluid from the blood.¹ This is highly speculative, and assumes that chorea is an infectious disease. Improvement was striking, but there was no complete cure.² Others have used injections of autoserum for chorea. The serum is taken from the patient's blood, and

¹ L. Porter, *Amer. Journ. Dis. Child.* 1918, vol. xvi, p. 109.

² *Pract. Med. Ser.* 1918, p. 57.

injected into the spinal subarachnoid space. It is yet too soon to appraise these methods, but in view of the fact that chorea is often a self-limited disease, and that many patients recover with rest and isolation, this intraspinal treatment does not seem to be indicated, except possibly in severe cases.

The treatment for chorea is mainly symptomatic. If the movements are very violent, sedatives are indicated, especially the bromides and chloral; but unless given in very large and depressing doses, they are often disappointing. Trional is said to be better than chloral. Ether and chloroform are but temporary in their action, and a patient cannot be kept anæsthetized all the time. Cold baths are recommended by some, but they are not likely to be well borne by young children; the warm bath may be better. Cold packs have been found beneficial. Care should be taken to prevent the patients from injuring themselves. The nutrition must be carefully maintained. Cisticifuga, which once had a reputation for this disease, is now scarcely heard of.

The chorea of pregnancy is sometimes of a very severe type, and fatal cases have occurred. It is relatively more common in primiparæ, and in women who are illegitimately pregnant. The treatment is practically the same as for the usual form, but the question of inducing abortion or premature labor will arise in severe cases. Experience has proved that such measures do not always cure the patient, and they expose her to some additional risks, such as shock and puerperal infection. It is a question to be determined largely by the obstetrician. Dereum has found luminal useful in one case of chorea insaniens occurring in the puerperium. It was given in doses of 0.2 gram (3 grains) under the skin every four hours.

Adult chorea, or Huntington's chorea, is usually hereditary, or familial, and is chronic and incurable. These patients sometimes show mental symptoms, especially in long-standing cases, and may be suicidal.

XXVI. EPILEPSY.

For many years the standard treatment for epilepsy has been with the bromides; but this treatment has never been satisfactory, for the bromides do not cure epilepsy, unless in a very few cases, and their continued use for long periods is attended with not a few evils. Claims are made, indeed, that they are curative in mild cases, especially in children and young persons, when the treatment is commenced early, and all neurologists have probably seen such cases. They have a power of control, however, even in confirmed cases, and this power assures them a permanent place in therapeutics.

The writer has found it advantageous to combine small doses of iodide of potassium with the bromide in these early cases in children. Very large doses of either drug are not required, as a rule, in such cases, but the combination should be used persistently in small doses, and great care should be taken of the patient's general health. It is particularly important to keep

the stomach and bowels in good order. Overeating, constipation, over-sleeping and a too sluggish life, are to be avoided. Outdoor life is to be secured, and some light and agreeable occupation in older patients. The good results obtained in special institutions are doubtless due to the hygiene, normal life, outdoor occupation and attention to details as much as to medication, and even more so.

These children should not be sent to a public school, and attempts to push their education should be avoided. They should also be protected from all exciting and disturbing causes.

The withdrawal of table salt during the administration of the bromides has been insisted on, following the recommendation of Richet. It is claimed that the sodium bromide takes the place of the sodium chloride in the tissues, and thus acts more effectively. The use of the borates has recently been revived by Marie and others.¹

In confirmed cases the bromides may be abused and a condition of bromidism kept up which is objectionable. It is impossible to lay down rules for dosing, and this matter must be left to the judgment of the practitioner and the exigencies of the case. Even in these confirmed cases much good can be done by hygiene, exercise, and occupation. Nothing is more depressing than to see a lot of epileptics sitting idly about in a hospital ward waiting for the next fit.

Luminal has been recommended by Dercum for epileptic patients.² The dose is 0.13 gram (2 grains) of luminal sodium, or 0.1 gram (1½ grains) of luminal, given at bed-time. This drug is said to be particularly efficacious in chronic cases.

Fournier described the epilepsies that are due to syphilis. This relationship is really one of the unsolved problems of the sacred disease. It is possible that so-called essential epilepsy is sometimes the expression of a syphilitic infection, especially in congenital syphilis. Proper tests should be made, and if evidence is found of the presence of the spirochaetes, an anti-syphilitic treatment should be tried.

Symptomatic epilepsy is caused by gross lesions of the brain, such as tumors, abscesses, and injuries. Surgical measures are then to be adopted. Traumatic epilepsy especially may be relieved, if the injury is to the motor cortex, and the operation is done promptly. Focal epilepsy was formerly thought to be an indication for excision of that part of the motor cortex affected, but experience has not confirmed this opinion. Pituitary lesions may cause a special type of epilepsy, the so-called uncinate type, in which a gustatory or olfactory aura ushers in the fit. Pituitary extract has been used, also thyroid extract on somewhat theoretical grounds. Pituitary tumors, however, are now not infrequently excised.

Epileptic status is caused by a rapid succession of fits, during which the patient lies comatose. The advisability of lumbar puncture, and even of intraspinal medication, for instance, with magnesium sulphate, as has

¹ Bull. de l'Acad. de Med., June 1, 1920.

² F. X. Dercum, Arch. Neurol. and Psych., May, 1919.

been used by Marinesco in chorea, is merely suggested here, for the writer has had no experience with these methods, and hesitates to assume the responsibility of advising them.

XXVII. MIGRAINE.

As said elsewhere, migraine is one of the explosive neuroses, the cause of which is not known (Vol. II, p. 833). It is hereditary in a large proportion of cases, but that fact does not prove that the immediate cause may not be some autoinfection. The disease shows itself in paroxysms, which are marked by disorders of vision, pain in the head, and vomiting.

The treatment for the attack with sedative drugs is not very satisfactory, for the stomach is usually deranged and does not tolerate medicine. The fact that the attack in its natural course is usually terminated with vomiting, suggests that an emetic may act as an abortive, and the writer has found that this is sometimes so. If the stomach is emptied at the very beginning of a paroxysm, relief is secured, and either the attack is promptly aborted, or the later symptoms, particularly the pain, much mitigated. The writer has known a dose of ipecac to be more effective than attempts to combat the nausea and headache with symptomatic treatment. The same effect may be secured in some cases with a mild laxative, such as Rochelle salts or citrate of magnesium, provided the stomach will bear it.

The symptom which most urgently demands relief is the headache. This comes on gradually as the prodromal symptoms, which are usually disorders of vision, such as amblyopia, disappear. The pain increases until it reaches its acme, and then slowly recedes; this stage lasts for some hours, or in severe cases for even a day or two. The patient is depressed, and after the attack is not a little prostrated.

The attack of migraine has a natural evolution, and is self-limited; the paroxysm recurs in precisely the same way in the individual, and terminates in its own time. These facts in the natural history of the disease serve to explain the success which is often attributed to drugs; the patient recovers, and the particular drug gets the credit. It is customary to prescribe bromides, antifebrine, phenacetin, antipyrin, or caffeine, in various doses and combinations. These may secure a measure of relief, and one or other of them may be tried. Some patients from long experience find the drug which they prefer, and use it without medical advice. In fact, in most cases the physician is not called on to treat the paroxysm. It is accepted by the patient as a thing of course, and he is his own therapist. Morphia should not be used, because of the risk of forming the habit; moreover, it is likely to upset the stomach, to cause unpleasant reactions, and thus to intensify some of the suffering.

Lauder Brunton claimed that the attack of migraine, if taken at the start, could be aborted with a dose of 1 gram (15 grains) of sodium salicylate and 2 grams (30 grains) of potassium bromide. This treatment could be combined with the use of a laxative.

The tendency now to trace obscure diseases to disorder of one or other of the endocrine glands is seen in the case of migraine. Timme thinks that migraine is caused by disease of the pituitary gland, and he explains the various disorders of vision, paralysis of the oculomotor nerve, and headache, as due to enlargement of this body and pressure on neighboring nerves and vessels.¹ If this is a plausible theory, it suggests the use of pituitary extract, and possibly thyroid extract, for the latter seems to fit in somehow in all these schemes of glandular treatment.

Peptone has been given as a prophylactic on the theory that migraine is caused by certain alimentary albumens. But if this is so, a laxative, as already suggested, would seem to be a better remedy.

The old writers, especially the English and French, believed that migraine had some mysterious relationship to gout. Trousseau said, "migraine and gout are sisters." Hence a treatment directed for that disease was formerly advised. Today not a few writers pin¹ their faith to salicylate of sodium. Elaborate plans of diet, hygiene, hydrotherapeutics, and elimination are described in the books, but the difficulty is to persuade the patients to follow them. They become careless or resigned, and go about their daily affairs, prepared to accept the inevitable.

XXVIII. THE OCCUPATION NEUROSES.

As described elsewhere in this work, these neuroses include such affections as scrivener's palsy, telegrapher's cramp, piano-player's hand, and similar disorders in bricklayers and other artisans (Vol. II, p. 831). They are caused by the overuse of certain groups of muscles in the course of occupation. The commonest of them formerly was scrivener's palsy, but the wide use of the typewriter has doubtless made it rare. Telegrapher's cramp, as first described by Onimus, is apparently not so common as might be supposed from the large number of these operators.

The treatment for all of them is practically the same.² Prophylaxis is better than cure, but these patients usually are not seen until long after the disease has declared itself. They cannot afford to give up their occupation, and they fight against their infirmity, or even try to conceal it, until it has become fixed and incorrigible.

Scriveners sometimes can find relief, or even a preventive, in the use of a stub-pen. This pen requires a much less fine muscular adjustment than one with a sharp point, and is therefore less fatiguing. An old remedy is a very large penholder, sometimes immense, which tends to prevent the cramp into which the muscles are thrown promptly by attempts at holding a slimmer one. These large penholders are sometimes made of cork for lightness. A soft rubber cover for the ordinary penholder is said to act well, probably by requiring a less firm grip than a hard one. Such devices are only makeshifts, and at best they only put off the evil hour when the

¹ W. Timme, *Arch. Neurol. and Psych.*, June, 1920.

² See the writer's article on "The Occupation Neurosis" in *Hare's Modern Treatment*, vol. ii, p 582, in which the treatment is discussed at greater length.

patient is quite incapacitated. The training of the other hand to write has been tried, but the disorder is likely to show itself in that hand too in a short time. The substitution of the typewriter is said not always to succeed, as the overuse of this instrument can cause a somewhat similar neurosis. In the case of telegraphers, a cramp occurs and tends to draw the hand away from the key. A very large handle, even as large as a door knob, has been tried.

The only successful treatment for any form of occupation neurosis is complete rest, by which is meant quitting work. The hand may still be used for ordinary purposes, but the particular use of the muscles must be entirely suspended. Unfortunately many cases relapse, and the question of giving up the work entirely may have to be met.

Not a few of these patients become slightly neurasthenic. They are naturally discouraged, and sometimes suffer not a little from loss of tone. The use of alcohol and tobacco may add to their troubles. They require a general tonic treatment.

Local treatment of the arm and hand should be tried. Massage may be helpful. Electricity should be used cautiously, and anything like overstimulation with strong currents and prolonged applications should be avoided. Baking the arm has been recommended. The use of splints is not advised.

The muscles may be sensitive, and painful points and even neuralgic symptoms may be present. Sedative drugs, however, are contraindicated; and, in fact, no drugs have a direct action on the neuromuscular apparatus which is affected. Strychnia may be tried in moderate doses.

Piano players sometimes have a painful form of disablement, in which cramp is not common. The small muscles and ligaments of the fingers and hand are probably overstrained. These patients, especially women, may become hysterical, and the only thing for them to do is to give up practice for an indefinite time.

XXIX. PARALYSIS AGITANS.

Unfortunately there is little or no treatment that avails in this disease. It is usually an affection of advanced life, and has not a few of the appearances of senility. To recommend a quiet and retired life is superfluous in the case of a patient who can lead no other. For a description see Vol. II, p. 836.

These patients sometimes suffer not only from the disablement, but also from a mild psychosis not unlike a melancholia. They also have pain in their stiffened joints, especially the knees. Impaired digestion and insomnia are troublesome symptoms, and in a few cases there may be weakness, without true paralysis, of the bladder. All these things require a symptomatic treatment.

The depression of spirits is best relieved by keeping up the general nutrition, also by mild stimulation, as with port or Burgundy wine, by

diverting reading, and companionship. Rest treatment is not good for these patients, as it tends to make the stiffness worse, and increases the mental depression. They should be encouraged to use their limbs, to go about a little, especially out-of-doors, and even to take light systematic exercise. Massage goes well with the last-named, and an anodyne liniment to the knees. In advanced cases, as the patients become more enfeebled, they can still be moved about in wheel chairs, and even taken on rides. In the case of an old lady past 80 years of age, a daily ride and an opium suppository at night are the only things that make life endurable.

As for the tremor, there is no drug that controls it, although many have been tried; hyoscine, for instance; but its long continued use is objectionable. A moderate dose of opium at bedtime is allowable, and this drug may be used for a long time without increasing the dose. In cases in which there is insomnia, with great depression of spirits, it is really a necessity. Tonics are to be used as occasion demands. Parathyroid extract has been recommended on the theory that there is disturbance of the functions of these glands, but it is only theory. The weakness of the bladder may require the use of an adjustable urinal; in the case of women, displacement of the pelvic contents may require mechanical support. This may restore a measure of control to the bladder, for this organ is not really paralyzed.

The results of the studies of J. Ramsay Hunt on the relationship of lesions in the corpus striatum to paralysis agitans are interesting, but they furnish us with no grounds for treatment.¹

XXX. THE VASOMOTOR DISORDERS.

As a field for therapeutics, this is not very fruitful territory. Not a little has been written lately about *vagotonia* and *sympathicotonia*, under which obscure terms still more obscure conditions are described (Vol. II, p. 839). The sympathetic nervous system has various functions, but whether their disorders can be successfully controlled with drugs is a question. The tendency now is to confuse the subject still more by ascribing many of these disorders to some fault in one or other of the endocrine glands. Hence a rather hasty and even reckless administration of various glandular extracts is advised. The whole subject is obscure, and from the standpoint of the neurologist it is unsatisfactory. In these pages therapeutics alone will be discussed, and vague theories of pathology will be ignored.

XXXI. RAYNAUD'S DISEASE.

The most striking of the so-called vasomotor diseases is the affection named after Raynaud, which is described elsewhere. (Vol. II, p. 840.) Very little that is valuable in treatment has ever been suggested. Most studies have been expended on its causation and pathology.

Epinephrin has been advised for obvious reasons, but it does not seem to have met with wide favor. Thyroid extract also has been prescribed—

¹J. R. Hunt, *Brain*, 1917, vol. xl, p. 58.

as it is nowadays for almost everything. The usual nerve tonics have no effect on the attacks; nor have the bromides or nitrites. The extreme pain in some cases suggests the use of opiates, but they ought not to be given, lest they induce the habit. Raynaud himself believed that electricity could act beneficially on the vasomotor centers, and this agent has been much used. Galvanism is claimed to have the power to prevent, or relieve, the attack; and Barlow applied it by placing the hand in a basin of warm salt water through which the current was passed from one electrode held in the water to the other held on the limb.¹

The use of systematic compression, by tourniquet or band fastened around the limb, has been claimed to give good results. A convenient method is by the ordinary apparatus for taking the blood pressure. By shutting off arterial circulation, the pain is relieved. Good results have been reported by Osler, Cushing and others. Schwab has even reported the disappearance of gangrene after the use of compression.² If the arterial circulation is completely shut off, the pressure should be applied for only a few minutes.

On the theory that malaria may be a cause, large doses of quinine have been given, but without noteworthy effect.

When gangrene occurs, amputation of the affected fingers or toes is necessary.

Trophic lesions occur in syringomyelia, leprosy, and even in injuries to nerves, as the median nerve. A careful differential diagnosis is to be made.

Veillet reports a case of Raynaud's disease in a French soldier in which he excised the peri-arterial sympathetic nerves from off the brachial artery, with alleged good results.³

XXXII. ERYTHROMELALGIA.

It may be doubted whether this is a distinct disease or anything more than a syndrome of various morbid processes. It is classed with the vasomotor affections, but examination of the tissues has shown that, not uncommonly, neuritis and arterial sclerosis are present. (Vol. II, p. 842.)

The "red neuralgia" is an obstinate affection, and the only two things that seem to control it are rest and cold. The affected limb should be kept elevated, and complete rest in bed is to be advised when the attacks are frequent, or the condition tends to persist. The few cases in which anything like recovery has been reported were instances of the value of prolonged rest. The patients themselves usually find out that cold applications give relief, and on the contrary, that heat aggravates the pain. The cold may be applied in the form of an ice-bag, or, better, by wrappings of flannel wrung out of iced water; but these should not be kept on for too long a time.

Massage and electricity are unendurable in the attacks and useless

¹ T. Barlow, Allbutt's Syst. of Med., vol. vi, p. 605.

² H. C. Moffitt, in Musser & Kelly's Pract. Treat., vol. iii, p. 956.

³ L. Veillet, Bull de la Soc. des hôp., May 31, 1918.

between them. Drugs also have no effect on the local condition; but careful scrutiny of, and attention to, the general health, especially of the heart, kidneys and vascular system, are important. The hypodermic injection of morphia and atropia, as formerly advised, is of doubtful value except for its immediate effect. None of the various glandular extracts is indicated, although epinephrin has been recommended on the theory that it controls the capillary circulation. Digitalis and strychnia have also been lauded. Bandaging the limb may be tried. Weir Mitchell advised stretching and even excision of nerves; and amputation of the limb has been done in a few cases. It might be well to try injections of alcohol into the main nerve trunks, as is done now for various forms of neuralgia.

XXXIII. ANGIONEUROTIC ŒDEMA.

This also is described as a vasomotor affection (Vol. II, p. 843). Not a few drugs have been tried and recommended, but their wide variety shows that they are not reliable. Among these drugs are the calcium salts, nitroglycerine, epinephrin, quinine, strychnia, arsenic, and atropia. The swellings have been relieved by the application of collodion, also by the elastic bandage. Attention to the general health is important. Heredity and a neuropathic tendency are among the causes assigned, and may demand special treatment. Various toxæmias, as from the ingestion of certain foods, may be present, and require free elimination by the bowel. Altogether, the causation is obscure and the treatment is empirical.

Angioneurotic œdema of the glottis has been reported, and death has even been ascribed to it. Local spraying with epinephrin is recommended. Gastro-intestinal symptoms, such as vomiting and colic, may indicate a local œdema of the mucous membrane, and the patient is to be treated with laxatives.

XXXIV. ACROPARÆSTHESIA.

The symptoms of this affection seem to ally it with Raynaud's disease, but the relationship is denied by some writers. There is apparently a vasomotor disturbance, which is shown by paroxysmal attacks of numbness, tingling, paræsthesia, and even pain, along with pallor and coldness in some cases. The affection is most marked in the fingers, or even confined to them, and evidently is often caused by occupation, as it is seen particularly in tailors, seamstresses, washerwomen and laundresses. The indications are that it is a purely local affection, due to irritation of the nerve-endings and the small blood vessels.

The treatment is by the removal of the cause, and the use of tonics and local applications, especially electricity in the form of faradism or high-frequency currents, also warm salt water baths and massage. Drugs are without local effect. Ergot was once lauded, but soon fell into disuse. Epinephrin will be sure to have its advocates; but if the affection is due to constriction of the arterioles, this substance is not indicated.

XXXV. DISEASES OF THE MUSCLES.

The *myopathies*, as they are called, are described in another part of this work (Vol. II, p. 849). They include a rather wide group of affections in which the lesions are confined to the muscles. In recent years the study of the *myotonias* has led to the recognition of defects in the lower motor neuron in the spinal cord; and there is another group—the Charcot-Marie-Tooth type—in which the changes are believed to be in the peripheral nerve endings. *Myasthenia gravis* is also usually classed among the muscular diseases, although its pathology is still a subject of discussion.¹ These distinctions are not very important from the therapeutic standpoint, as these diseases are usually chronic and incurable. There has been a tendency to see in some of them the effects of disordered internal secretions, and the use of various glandular extracts has been advised, but this therapy is not yet fixed on secure foundations.

In the treatment for *myasthenia gravis* a caution is given by a recent Swedish writer against tube-feeding and the use of strychnia.² Oppenheim saw a fatal result from tube-feeding. Strychnia is contraindicated because the object of treatment should be to secure complete rest for the muscles. Hence massage and electricity are also contraindicated. Rest in bed is essential. Various organic extracts have been used in a rather haphazard way. Among these are thyroid, pituitary, and ovarian extracts, but the results have not been satisfactory. On the theory that the thymus gland is over-acting, its removal has been suggested, but this operation is not to be recommended on the basis of our present knowledge. These patients could not well bear anæsthesia and surgical shock.

XXXVI. MENTAL DISEASES.

The treatment for only such mental diseases as are likely to claim the attention of the general practitioner will be discussed here. Insanity is a disease of the brain, and as such it claims a place in any well-considered system of therapeutics, at least insofar as its problems have to be met by those who see these cases in their early stages, and who may even be expected to conduct the entire treatment in the milder or curable forms. Of recent years, the tendency has been marked to distinguish such cases, and to give these patients the benefits of extramural treatment. Thus has grown up a psychopathic service in some of our general hospitals. Patients are admitted as early as possible for purposes of observation and diagnosis, as well as for prompt treatment, in the hope of an early cure and the prevention of a prolonged or chronic stage. Good results are often obtained, and the patient and his or her family are saved from the pain of the much dreaded certification.³

¹Pract. Med. Ser. 1919, p. 207, in which is abstracted a paper on the Classification of the Muscular Atrophies by Wachslcr in Neurolog. Bull., Nov.-Dec., 1918. Also *ibid*, 1920, p. 166.

²G. H. Mourad-Krohn, abstract in Pract. Med. Ser., 1918, p. 215.

³J. H. Lloyd, in Musser and Kelly's Practical Treatment, vols. iii and iv. W. B. Saunders Co., Philadelphia. Reference is made to these chapters, in which the subject of treatment is discussed at length.

The advantages of extramural treatment for some classes of the insane are as follows. In the first place, these patients are merely sick, and they are to be regarded in the same light as other sick people. Their affection is not merely mental, but is in a larger sense physical. This is shown by the fact that the bodily functions, such as digestion, assimilation, the blood-making power, sleep, and menstruation, are often seriously deranged. In fact, cure often depends upon the successful treatment of the patient for some or other of these derangements. This can be done in selected cases quite as well in a general hospital as in a special asylum for the insane.

In the second place, the avoidance of a legal certificate of insanity is of no little importance in some cases. The prejudice against certification is wide-spread and natural, and it sometimes acts to prevent the patient from receiving the prompt treatment which is needed if an early cure is to be obtained. It is useless to deny that certification is thought to put a mark upon a patient, and therefore is sometimes resisted to the last moment.

The extramural treatment of the insane may be conducted in several ways; as, for instance, in the patient's home, or in a special sanatorium or in a general hospital.

The home treatment for insanity in any form is not to be advised unless in very exceptional cases. In the usual case, the expense is often greater than can be fairly borne; the nursing is likely to be inadequate; discipline soon becomes lax; the anxiety and interference of relatives are constant sources of embarrassment; the patient becomes tyrannical; the whole morale suffers; and failure is not uncommon. Nothing can be more demoralizing than the presence of an insane patient in the ordinary household, and the physician is usually well advised who declines to take the responsibility of such a case. Nevertheless, it sometimes happens, especially in the early stages of an acute attack, and with people who have the means, that a trial of this method is demanded. The physician who assumes the risk is wise to have it clearly understood that it is against his better judgment, and that if things go wrong, he is not to be the one blamed. He should have the support of a good consultant, and should be especially careful in the selection of his nurses.

The cases in which home treatment is likely to be required are those of the deliria or the psychoses due to infection or toxæmia; mild cases of melancholia, or the manic-depressive psychoses; and the ordinary cases of psychasthenia or the psychoneuroses. Not a few patients, also, in the early stages of dementia præcox and the paranoid group are kept in their own homes, although as a rule such patients sooner or later require institutional care. The patient in delirium tremens caused by alcohol; the patient with a puerperal confusional psychosis; or the one who has a "nervous breakdown" due to some exhausting or demoralizing episode; such cases, for instance, as were seen in soldiers and even in trained nurses during the Great War; all these require early or even prolonged treatment, if not in their own homes, at least not necessarily in an asylum for the insane.

Treatment of the insane in a special sanatorium has some advantages

which are obvious; but much depends upon what kind of a sanatorium it is, and how and by whom it is conducted. This mode of treatment secures privacy; it usually avoids the need of certification; it commands the services, usually if not always, of trained experts and skilled nurses, unless the commercial spirit dominates it, in which case it should be avoided. Among the disadvantages are the expense, and the fact that few of these small sanatoria are as well equipped with laboratories as large general hospitals, or with such means for occupation, amusement, and outdoor life as are found in large special hospitals for the insane. Nevertheless, in simple acute cases with a favorable prognosis the treatment in a small private sanatorium often gives most satisfactory results.

Patients with violent tendencies, such as homicidal or suicidal impulses, are not proper subjects for treatment in their own homes or even in small sanatoria, and the danger from such patients must never be ignored. Even in the puerperal cases such impulses occur, and the patient has been known to kill herself or her infant. The writer knew of a trained nurse, in a large hospital in Philadelphia, who, in the delirium of typhoid fever, threw herself out of a window and sustained injuries from which she died.

There is much to be said in favor of a psychopathic service in large general hospitals, although the authorities of such hospitals, and even the medical profession itself, are hardly educated up to that point as yet. Nevertheless, such a service is in practical operation in some of our large cities, notably in the Philadelphia General Hospital. The advantages of such a service are numerous. It puts the insane patient practically on a plane with other sick persons, and provides for him or her all the benefits of exact diagnosis, careful nursing, and skilled treatment. Such hospitals are fully equipped with laboratories as aids to exact clinical study; they have a staff of resident physicians always on hand; they have a full staff of internists, surgeons, and specialists for consultation; they have a body of well-trained nurses; and they have the advantages of a good routine and thorough discipline. There is a sense of security in having a patient in such a hospital which is probably felt nowhere else.

On the other hand, such hospitals are not adapted to the treatment of all kinds of insane patients. It is only, as a rule, in the acute cases of confusional or delirious insanity, mild cases of melancholia, and especially in the cases of the psychoneuroses, that the patients are welcome in such hospitals, or can be properly treated in them. Patients requiring seclusion and rest treatment, and those especially in whom the prognosis is reasonably good, and who are able and willing to coöperate, are the proper ones. Patients in active mania, noisy and unmanageable; or those with violent impulses, such as homicidal and suicidal tendencies; or paranoid patients with systematized delusions; or general paretics (unless for specific treatment) are not appropriate patients for such hospitals. The prejudice against them is naturally great on the part of the authorities, as well as of the physicians and nurses. Such patients require to be immured in special hospitals for the insane.

Among the disadvantages, if they are truly such, which are urged against general hospitals, is the fact that they are usually located in the thickly settled parts of large cities, and therefore give little opportunity for outdoor life; but as the patients mentioned here usually require treatment in bed, at least in the early stages of their disease, this objection does not hold. What may be called the atmosphere of a large general hospital—the sights and sounds—is also disturbing to some highly nervous people, but this objection can usually be overcome, and its reasons are not manifest in some of our best conducted hospitals. These patients, as a rule, however, ought not to be admitted into a ward with patients suffering from other diseases. Isolation is usually a necessity for them; at least, if there are exceptions, their associates ought to be carefully chosen. On the other hand it is a question whether mental invalids ought to be “herded” together. They are usually too self-centered, however, to pay much attention to the troubles of others.

Very little need be said here about the merits of the special hospitals, or asylums, for the insane. They are among the best of our institutions, and their administration and the scientific work done in them place many of them in the front rank. In accord with the spirit of the times their doors are always open to the very class of patients to whom reference is made above; the early, acute, and undetermined cases, in which it is not advisable that the patient be certified. They have thus an active “psychopathic” service, and as their buildings and grounds are well equipped with everything essential for the study of mental disease and the treatment of such patients, their advantages over other hospitals are often very great. It is only prejudice that tends to keep patients out of them, or the fear of certification, or the dread of association with other insane, or the desire of the general practitioner and the specialist to have control of the patient in a private or semi-private environment. It is customary now to admit suitable patients on voluntary commitment; that is, without certification; for the purposes of observation and treatment, until a cure is effected, or until it becomes evident that a legal certificate is needed. Thus not a few patients in the early stages of what might in time become a grave psychosis, are rescued from such a prolonged mental malady. The objectionable term “asylum” is now generally abandoned, and these useful and necessary institutions are known for what they really are—hospitals for mental and nervous diseases. However, in the case of patients suffering from the psychoneuroses, such as psychasthenia and the graver forms of neurasthenia, the objections to the hospitals for the insane are not to be ignored. These patients are not to be associated with the insane, and this sentiment will probably always serve to secure for them extramural treatment.

A word here about the certification of the insane. The physician who signs a certificate of insanity assumes a large responsibility, for to declare, under oath and before a magistrate, that a person is a lunatic is a somewhat formidable procedure and has enduring results. Nevertheless, it has been held by some courts that such a certificate is merely a physician's written

opinion that the person is insane and a proper subject for commitment, and is not a warrant to commit or detain him. Hence, if the physician has acted in good faith, an action at law will not necessarily lie against him. His whole task is to make a diagnosis, and to state his reasons for it in brief language, describing the chief symptoms. The general practitioner will do well to have as his associate some well-recognized specialist, as the law in most states requires that the certificate be signed by two physicians.¹

It is not desirable here to enter into a prolonged discussion of the various forms of insanity; it is sufficient to state briefly what these various forms are, and to indicate those especially in which the general practitioner is likely to be called on to form an opinion, and even on occasion to conduct the treatment.

The classification of insanity has been a much debated subject, but the simplest is the most useful for our present purposes. There are at least five general classes of mental disease which are readily recognized, and these may be designated as: (1) The Deliria, (2) The Manic-Depressive Group, (3) The Paranoias, (4) The Psychoneuroses, (5) The Dementias. In discussing these it will not always be easy to follow a strictly logical course, but exceptions and variations will be pointed out, and the therapeutic motive will always be kept foremost.

(1) *The Deliria*.—This group includes those forms in which there is confusion, delirium, and in some cases stupor, even advancing in grave cases to a comatose stage. Possibly the best illustration of this affection is the delirium which often accompanies typhoid fever, pneumonia, and other infectious diseases. In other cases there is merely confusion, disorientation, and a general disorder of the mental faculties, hence called *confusional* insanity. Hallucinations of sight and hearing are often present, and delusions of a fragmentary and fleeting kind may be evident. There may be very marked physical derangements, such as fever, anorexia, insomnia, emaciation, and great prostration. The true delirium of typhoid fever suggests that these similar confusional states are due in some instances to infection or toxæmia; in other cases the cause may be exhaustion, overwork, faulty hygiene, emotional shock, or some dyscrasia. The cause is, however, not always easy to determine, but the symptoms indicate that the disease is primarily a physical one; that the mental disturbance is the result of a bodily disorder. To this group may be assigned the toxæmias due to alcohol, lead, morphia, cocaine and other drugs; and various infections, some of which remain to be determined; as well as dyscrasias, such as gout, rheumatism, and derangements of metabolism, as seen in nephritis and disorders of the endocrine glands. Among specific, or infectious, causes is to be included syphilis, although the characteristic *dementia paralytica*, or paresis, is so distinct that it is usually described apart, and in this work the treatment for it is discussed elsewhere. But syphilis may also cause an acute dementia or amentia, which is to be

¹Wharton and Stille's Medical Jurisprudence, 5th Ed., vol. iii, Chap. lviii, in which the subject of "The Examination and Certification of the Insane" is discussed at length by the present writer.

distinguished from paresis and which is amenable to drugs. Tuberculosis, malaria, influenza, and doubtless other infections, may cause mental disorder of a confusional or stuporous type. There is an acute and very rapidly fatal form, called *delirium grave*, or Bell's mania, for which no distinct cause has yet been determined; it may be due to more than one agent. Grave forms of delirious or confusional insanity may occur in or follow the puerperium. During the Great War many cases of confusional insanity were observed, and these were doubtless caused by the hardships, privations, dangers, and emotional excitement so common in active military life. The rôle of heredity must not be ignored, for in the war such cases were not infrequently seen in those who were constitutionally unfit. There is also a post febrile delirium, or confusional state, which, as its name indicates, comes on during convalescence from one or other of the infectious diseases, such as typhoid fever or influenza; this is doubtless due to toxæmia combined with the exhaustion and malnutrition caused by the disease. Post operative insanity is usually of this form, and shock and infection are probably active causes in such cases.

The *treatment* of a patient for the active delirium which accompanies one or other of the infectious diseases, such as typhoid fever or pneumonia, is merged largely in the treatment for the disease itself. In treating alcoholics in such infectious deliria most authorities urge the continued use of alcohol, but the present writer is not sure that the advice is good; at least, such doses as are recommended by Ortner, one half of a fluid ounce of whiskey every hour, are entirely too large. The delirium *potu suspenso*, which comes on sometimes when the chronic inebriate is deprived of his drink, and may thus complicate pneumonia or a surgical operation, is to be guarded against by the cautious use of alcohol. Potter claims that delirium tremens can be prevented in such cases by the prompt administration of plain whiskey or eggnog. But his advice to give a cool or cold pack, or even a cold bath, at the first sign of wandering, is probably better. He also urges extra feeding. Ortner advises opium or morphia in full doses. Others prefer chloral, a drug which has been much used and much abused in this delirium. Potter says that hyoscine is as dangerous as helpful. The bromides are not of much account. Paraldehyde is claimed to give good results, but the sleep which it produces is usually of short duration, and the disagreeable taste and odor of this drug are objectionable. Trional, sulphonal and barbital are all of some use. But the attempt to control delirium in any form by mere drugging with powerful sedatives may lead to great abuse; it is merely adding poisons to a system already over-powered by poison; and it is doubtful whether such treatment can do much more than to cover up for a while an unpleasant or dangerous complication. The practitioner will usually feel himself driven to the use of one or other of these sedatives, but it will be more rational in him to endeavor at the same time to combat the delirium by a sustaining treatment with good nourishment, and to use elimination and bathing. The state of the kidneys should be carefully observed. Plain water is a good diuretic and should

be given freely. As already said, a cold pack or a warm continuous bath is preferable to powerful drugs. But the bath is not always easily administered, especially in private practice: more will be said on this subject presently. The cold or warm pack is easily given, and not only promotes sleep but also causes free sweating, and thus aids elimination, and it does not add poisons to the system. It is to be borne in mind that some delirium is inevitable in many of these cases; that it cannot be promptly or efficiently controlled by drugs; and that the best that can be done is to sustain the patient, to nourish him, and to promote the elimination of poisons from his system. We have no specifics that will do this.

The intraspinal injection of magnesium sulphate in grave cases of delirium tremens was tried by E. A. Leonard in the Philadelphia General Hospital. From 10 to 30 cc. of spinal fluid were withdrawn according to the degree of pressure, and a 25 per cent. solution of magnesium sulphate was injected in doses of 1 cc. for every twenty-five pounds of body-weight at a temperature of about 95° or 100°. It was claimed that good results followed, although two deaths occurred in the twelve cases, but these deaths were in very bad cases. Only one injection was given. A slight transient paraplegia occurred in a few cases.¹

H. V. Pike found that in some forms of delirium and stupor, not alcoholic, intracranial pressure was greatly increased, and in such cases he advised spinal drainage.²

Musser and Hufford tried lumbar puncture for the relief of the delirium in lobar pneumonia, with good results;³ but it is claimed that there is some danger of causing a pneumococcic spinal meningitis by this method.

Régis has put on record his protest against the continued use of alcohol in the treatment for delirium tremens. His paper is based on a series of eighty-four cases, in which only three deaths occurred. He relied on food, purgation, diuretics, and large quantities of water; and he gave from 2 to 3 grams (30 to 45 grains) of chloral and potassium bromide per diem. This eliminative treatment is rational, and is based on the idea that this delirium is caused by an auto-intoxication.⁴

Delirium tremens, indeed, may be said to be not a primary but a secondary effect of alcoholism. This is shown by the fact that it may not occur until some days after the withdrawal of the alcohol (the so-called *delirium potu suspenso*), and once it has started, it continues for days and even weeks without the ingestion of more of the poison. What the true pathology may be is still a question; it probably consists in changes of nutrition in the brain cells and even in pathological processes in the liver and kidneys. These facts should influence the therapist, for they indicate that sustaining treatment, elimination, and time are more needful than drugs. The same is true of some of the psychoses of infection, such as the

¹E. A. Leonard, quoted by Lloyd in Musser & Kelly's Practical Treatment, vol. iv, p. 923.

²H. V. Pike, Journ. Am. Med. Assn., Dec. 4, 1920.

³J. H. Musser, Jr. and H. K. B. Hufford, Journ. A. M. A., April 28, 1917, p. 1231.

⁴Régis, Journ. de Méd. de Bordeaux, July 26, 1908.

post-febrile delirium or confusional insanity. They continue long after the original disease has spent its force.

Puerperal insanity often takes the form of a confusional psychosis, and in these cases toxæmia or sepsis is to be suspected. It should always be searched for, although in not a few cases such a cause can not be found. Of course, if it is found, it should be eradicated. These patients not infrequently are in bad physical condition; the mental state may pass into one of acute maniacal excitement, with rapid exhaustion; and such patients require most careful nursing and feeding, along with tonics, baths, etc. Dercum has recently claimed good results from the use of luminal in a case of chorea insaniens occurring in the puerperium. But, as a rule, sedative drugs should be used sparingly. The prolonged warm bath gives better results.

Influenza may be followed by psychoses of various kinds, among which is the infection type here considered.¹ There is nothing characteristic, however, in these psychoses; that is to say, they are the same as those that follow other infectious diseases, and the treatment for them is practically the same. Some observers claim that there is usually a psychopathic element in these cases; that the infection only serves to set up a mental disorder on the basis of a constitutional defect. Pellagra causes an amentia, or confusional psychosis, which in time may pass into a dementia. The treatment for this is the general treatment for pellagra.

It is useless to enumerate all the various infectious diseases which can cause delirium or confusional insanity. Many of them have already been named, and they are familiar to all physicians. In the tropics also the acute febrile infections, such as yellow fever, plague, and malaria, furnish types of febrile delirium, or infection delirium, or the so-called delirium of collapse.²

The treatment is practically the same, except in such cases as call for specific medication, as in malaria.

Treatment with vaccines has been tried in some infections. W. Ford Robertson holds that certain forms of acute and chronic insanity are caused by infection of the brain by pathogenic bacteria, among which are the *streptococcus pyogenes*, *pneumococcus*, *bacillus typhosus*, *bacillus influenzae* and some others. But of greater importance are several species of neurotoxic diphtheroid bacilli. In thirty-four cases of acute insanity, proof of bacterial infection of great severity was demonstrated in all. Robertson used the autogenous vaccines of the invading bacteria, with alleged good results, even cure in some cases. In manic-depressive insanity and allied psychoses, which probably included the confusional or delirious types, the results were especially good.³ H. A. Cotton insists on the relation of focal infection, especially infected teeth, to mental diseases.⁴ H. S. Upson, of Cleveland, in 1908 reported cases of manic-depressive insanity and *dementia*

¹E. W. Fell, Journ. Am. Med. Assn., June 7, 1919.

²N. Austregesilo, N. Orleans M. & S. Journ., Dec., 1917.

³W. F. Robertson, Therapeutic Immunization, W. Wood & Co., N. Y., also Med. Press., December 14, 1921.

⁴H. A. Cotton N. Y. Med. Journ., April, 1920.

præcox, in which the patients recovered after infected third molars and other infected teeth were removed. But Charles K. Mills, of Philadelphia, utters a warning against these radical views. He reports a number of cases which illustrate the uselessness and harmfulness of what he calls "dental violence." He fears that if the craze for the removal of tonsils, teeth, and colon goes on, we may yet have a gutless, glandless, toothless, and even a witless race.⁵

Morphia, cocaine, and *cannabis indica* cause various confusional or delirious types of insanity. But such patients require institutional care; they are not treated successfully, as a rule, in general practice. Cocaine causes rapid deterioration, both mental and physical, and its victims need prompt isolation. In the East, hashish is the frequent cause of a dangerous maniacal psychosis. The sooner all these drug victims are put under restraint the better. It is well for the general practitioner to bear in mind that the morphia habit may be successfully concealed for long periods, and may thus cause curious and obscure complications.

George Bevier, of the Philadelphia General Hospital, informs the writer that the victims of drugs who are treated in that hospital belong to the flotsam and jetsam of the population; they are generally inferiors, of poor inheritance, and, like prostitutes and criminals, show degenerative stigmata. The habit is nearly always traced to evil companionship; it is a social disease and is certainly contagious. The fact must not be ignored, however, that drug habits are not very infrequent among the better classes of society also, among whom the solitary and concealed cases are not uncommon. Bevier finds that the present system of hospital treatment is not at all encouraging. There are many readmissions.

The snuffers of cocaine are not so common as the users of heroin; although many use various combinations of drugs. Morphia is more commonly used by women, especially by prostitutes. Those addicted to paregoric are usually old women, and are most difficult to treat. The smoking of opium is rare among those who seek treatment in the hospital. Heroin is more readily obtainable than morphia, is easily adulterated with lactose, and so can be handled at a greater profit by the peddlers.

Treatment consists, first, in withdrawing the drug; and, second, in building up the patient and restoring him or her to self-control. In the hospital the immediate withdrawal of the drug is favored. Some patients with considerable fortitude, prefer this method to the gradual withdrawal. The suffering is often intense, and this is met with belladonna or hyoscyne hydrobromide, even to the extent of producing a mild delirium for the first few days. The patient is bathed and kept secluded in a locked ward with a firm nurse. If withdrawal causes unfavorable symptoms, 0.015 gram ($\frac{1}{4}$ grain) of morphia is given. Active purgation is obtained with blue mass and magnesium sulphate. Water is given freely, sometimes with diuretics. Warm baths promote elimination, control restlessness, and are usually pleasing to the patient. Massage may be of value. These patients dread

⁵ C. K. Mills, N. Y. Med. Journ., April 17, 1920.

the coming of night, so in some cases instead of hyoscine a sedative of 1.3 grams (20 grains) of chloral and 2 grams (30 grains) of bromide of potassium is given for a few nights. The dose of hyoscine is rapidly cut down, and after forty-eight or seventy-two hours is stopped entirely. After this the quantity of food is rapidly increased, and broken-down patients often put on weight very fast. Tonics are indicated.

Symptomatic treatment may be necessary during this process of withdrawal. Cardiac weakness may call for digitalis, or spartein sulphate. In case of serious collapse morphia, of course, is necessary. Limb pains may be controlled with acetylsalicylic acid. Sweating is increased by pilocarpine or the hot bath. In cases of great restlessness and noisiness paraldehyde is useful. Vomiting is often difficult to control; laxatives, orange or lemon juice, bismuth and soda, are among the agents found useful; also mustard paste to the abdomen.

The second part of the treatment should begin when the patients leave the hospital, but unfortunately it is poorly provided for. These patients often go out with firm resolutions to resist temptation, but they are unstable, weak morally and physically, and they too easily succumb to the first craving for the drug and to the force of evil example. The after-treatment should consist of supervision, a pleasant environment, preferably in the country for a long period, with a definite policy of rehabilitation. This applies to all cases alike, of whatever social grade, but it is not always easily secured.

In the Philadelphia General Hospital the following rules are observed in the treatment of the psychoses of infection:—the elimination of possible sites of infection in the tonsils, teeth, gums, sinuses, ears, eyes, urethra, prostate gland, gall-bladder, gastro-intestinal tract, and female pelvic organs; the study of hypo- or hyperfunctioning of the thyroid, adrenal, ovarian, testicular, pituitary, and parathyroid glands, and the administration of appropriate glandular extracts; artificial feeding and the administration of large quantities of water; at bedtime hot milk and a hot bath; and trional or barbitol. Chloral and the bromides are avoided. For more excited patients a wet pack or a continuous warm bath is very efficacious. Intravenous saline injections and hypodermic injections of epinephrin are found useful in some severe cases.

The continuous warm bath is now much used in psychiatric practice. E. A. Strecker, of the Pennsylvania Hospital for Mental Diseases, Philadelphia, thinks that this bath is the most satisfactory means we have for allaying the excited states which are encountered in the psychoses.¹ The best results are obtained in that hospital in patients suffering from confusion and restlessness, with physical debility. The cases arising from infection and exhaustion are a good illustration of this group. After five or six hours in the tub many of these patients become quiet and drowsy, and often fall into a sound slumber after being placed in bed. The bath may be continued for hours and even days. The temperature of the water should

¹E. A. Strecker, *Journ. Am. Med. Assn.*, June 16, 1917, p. 1796.

be from 90° to 100°. If it is above 100° it may be debilitating, and this should be avoided, especially when a prolonged bath is required. Contra-indications are seen in advanced diseases of the heart and lungs, arteriosclerosis, ear-disease, and menstruation; although Strecker sees no reason why menstruation, after the first day or two, should prevent the use of the bath. The advantages of the bath are its soothing effects and the avoidance of sedative drugs. Some extreme claims have been made for it; as, for instance, that its proper use will abolish the use of such drugs altogether; but even if this be not so, it is certain that it will act as a substitute in many cases. The disadvantages are the difficulty and expense of administration, which limit the use of the prolonged bath almost entirely to the hospitals which have the proper outfit. The nursing is, of course, a large item, for the patient must be under constant supervision. A night-robe or a light garment should be worn during the bath.

(2) *The Manic-depressive Group*.—It was formerly the custom to describe mania and melancholia apart as distinct diseases, and the writer would prefer to do so, as this method appears to him to be more scientific and intelligible. But foreign influence has prevailed, unnecessarily, in this matter in America, and today we have the awkward double term. It is impossible to describe these diseases, however, unless this Siamese twinship is temporarily broken down.

In both forms there is a well-marked emotional instability. In *mania* this takes the form of expansiveness or exaltation. Ideation also is deranged. The ideas follow each other in rapid succession, until in advanced cases the patient may even be incoherent. He suffers also in his moral sense, as well as in his common sense, affections and judgment. His behavior becomes erratic. He is restless, unreliable, inattentive, and he may be also intemperate and lewd. His language flows freely, but his ideas are not controlled by his experience. He may have delusions, but these are not systematized and fixed. In other words, he is somewhat dis severed from reality; and in the mild form, called *hypomania*, he may engage in ambitious, but foolish, schemes, which come to nothing but the insane asylum. In severe or advanced cases there may be a violent or furious mania, in which confusion and disorientation are as marked as in some of the deliria; in fact, the border line between the two forms is not always clear.

The *treatment* of the maniac in private practice is not satisfactory; in fact, when the disease is once declared, the patient should be committed to a hospital for the insane. The difficulty and responsibility of caring for such a patient in his own home, or even in a general hospital, is too great to justify the general practitioner in undertaking it. In hospital treatment the measures to be used are not unlike those employed in the delirious or confusional cases. Careful feeding is necessary; even forced feeding may be called for. The wet pack or the prolonged warm bath is more efficacious than sedative drugs, although trional, sulphonal, or barbital may be used. Chloral is better avoided, and the opiates are not now generally advised by the best authorities. However, for very excited or resistive patients a

moderate dose of morphia, with or without hyoscine, is helpful just before putting the patient in the bath. Physical restraint is now generally condemned in books, but in actual practice some forms of it may be demanded in very violent cases. This is a subject for careful consideration, and it is best decided in the special hospitals. All sources of possible infection should be sought for, and elimination is a matter of course. According to prevailing opinion heredity is a frequent cause of mania; these patients are often constitutionally defective.

The hypomaniac is invariably the cause of great trouble and anxiety, and if he is allowed to remain at home, or anywhere outside of the asylum, his case is best managed—if it can be managed—by the specialist. Certification, or the attempt to commit him, often raises a storm; the patient resists and may appeal to the law; and the general practitioner, if he is wise, will have nothing to do with any such scheme. Let the specialists take the responsibility.

Melancholia is the opposite of mania. The emotional disturbance is one of depression, and this gives the whole tone to the case. This depression is sometimes described as “mental pain”; it centers about the personality, and is usually marked by a sense of personal unworthiness. Ideas, or delusions, take their main features from this sense of depression, and thus the emotional suffering is translated, as it were, into the most disturbing thoughts and impulses. Hence a constant source of danger in such cases is suicide; and the possibility, or even likelihood, of such impulses must always be borne in mind by physicians and attendants. The intelligence, or reasoning faculty, is not so much impaired as in mania; the patient, as a rule, is not confused; hence it is sometimes said that he is the least insane of all the insane. But this rule is not absolute, for in severe or advanced cases the patient may sink into such a profound depression that his condition seems like a stupor, hence called stuporous melancholia, or *melancholia attonita*. He remains mute for days, and even weeks and months, and takes no notice of his surroundings. He requires to be fed, and all his wants must be attended to almost as though he were a child; but even in these cases of profound depression the patients are not so much impaired in their intelligence as they seem, and after recovering they often recall clearly many things that occurred. These cases must be carefully distinguished from cases of dementia, which they superficially resemble. Another form is the agitated form, hence called *melancholia agitata*, in which the patient is restless and gives expression to his emotions in moans, cries and gestures. This condition may be mistaken for mania, but the emotional disturbance is quite distinct from that of mania.

In severe cases the patient may be delusional, and his delusions are sometimes of a hypochondriacal type, as of some ailment, or even of a foreign body, such as a living animal, within him; and he also has hallucinations of sight and hearing. In some cases the delusions are on religious subjects; in others they are based on sexual ideas or faults. There is the so-called *circular* form of insanity, in which periods of mania alternate with

periods of melancholia. These are the true manic-depressive cases, and they are usually the outgrowth of an hereditary defect. It will be said by some that even in the ordinary cases, as of mania on the one hand, and of melancholia on the other, the distinction does not always hold, as these patients often present phases both of exaltation and depression. Nevertheless, the separate type is clearly preserved in many cases, and justifies the distinction between the two forms in practical psychiatry.

Melancholiacs of a mild type may be, and not infrequently are, treated outside of the asylums. In fact, in very mild cases in which a hasty commitment is objectionable, this mode of treatment is not only desirable but necessary. The patient himself, and particularly his friends, object strenuously to his being sent to a hospital for the insane, and commitment might act injuriously. The patient may be apparently quite rational except for his depression, and his case may thus demand extramural treatment. This is a question, however, which requires the gravest consideration, for even in these mild cases suicide is an ever-present risk. The writer has had some unfortunate experiences with such patients, and he has grown cautious about assuming this risk or advising others to do so. In case it is decided to give the patient extramural treatment, the place and the methods must be carefully determined. As a rule, it is not well to treat him in his own home. A small special hospital or a good general hospital may be selected; a special sanatorium for nervous diseases is probably the best of all; but if the patient is coöperative, a private room in a general hospital has some advantages. The patient there has the benefit of a complete hospital equipment and routine. But the possibility of suicide, and the constant necessity of guarding against it, render such a case in such a hospital a most responsible one, and the hospital authorities are averse to having such a risk on their hands. Wherever the patient is treated precautions against self-injury must be taken, as in the location of the room, the security of the windows, the removal of all instruments or means, and the close surveillance of the invalid.

In most cases the rest treatment is called for; at least, it is always well to give it a trial. The patient should be treated promptly and thoroughly; no half-way measures should be relied on. Complete rest in bed often means, for such persons, relaxation both of mind and body. This method secures complete control of the patient and of all the details of treatment. A special nurse is required, sometimes two. Feeding should be done systematically, with due regard to the body-weight and the blood count. In order to permit full feeding, great attention should be given to the bowel. Even though Bouchard's theory of autoinfection, by intestinal putrefaction, has been overworked, it cannot be doubted that melancholiacs are better, and feel better, for free elimination by the intestinal tract. The skin also should be kept active by frequent bathing, and in restless patients the prolonged warm bath is beneficial. Large quantities of water should be given internally for the eliminative action by the kidneys. Massage is useful in some cases; but it is unpleasant to, and is resented by, some of the insane. Tonic medicines are useful, and the choice is to be left to the individual

practitioner. Sedatives, as a rule, are better avoided, unless insomnia is a troublesome symptom, in which case trional or barbital can be given. The treatment of melancholia with opium has had its advocates, but it is a treatment not to be advised or given haphazard. Opium, or its derivatives, doubtless has the power of relieving the mental pain, or psychalgia; and in cases in which this is unbearable and deprives the patient of the ability to eat and sleep, this drug might be given with advantage for a few days or nights in succession. But the after-effects of opium are always apt to be unpleasant, and the danger of coming to depend on it must be kept in mind. The endocrine glands have, of course, been enlisted in the treatment of melancholia. A German writer, Neste, thinks that the *status thymico-lymphaticus* is present in many suicides: he says that there is hyperplasia of the thymus and atrophy of the adrenals.¹ This would seem to indicate the use of epinephrin in patients with suicidal impulses. Orchitic extract has been recommended in some cases; also the thyroid gland in stuporous melancholia, and in cases occurring in the climacteric and during lactation.² But most of these suggestions are based on theory. At the Philadelphia General Hospital, as already said, a hypodermic injection of epinephrin has been found useful in the psychoses due to exhaustion. In cases in which there is marked physical debility the use of alcohol in very moderate doses is called for; the best form is probably a port or Burgundy wine.

In grave cases food may be refused, and the patient may require to be forcibly fed; but patients who are so ill as to need to be fed through a nasal tube, ought to be sent to the asylum, where this method is better understood and practised. If persuasion or force is necessary to induce the melancholiac to take liquid food, a glass or china vessel ought not to be used. The writer has known such a patient to bite a piece out of a tumbler.

Involuntional melancholia is the form seen in senility, and in commencing old age. There are often the associated physical changes of senility, such as arterial sclerosis. These patients are likely to be suicidal, and in advanced cases there may be present the mental deterioration so common in old people. The prognosis is sometimes unfavorable, and many of these patients require institutional care.

We hear sometimes of a partial or modified rest cure, in which the patient is allowed to be up and about for a few hours every day. Thus he may be taken into the open air, he can exercise, and even have some diversions, as rides or outdoor games. This treatment is adapted to very mild cases, but it is better postponed in most cases until the patient is convalescent. The advice which is sometimes given to take these patients on long journeys for "change of scene," is usually bad advice. The patient cannot be properly controlled and treated, and he does not leave his melancholy by the way.

There remains for brief discussion what may be called the psychological or direct treatment, which is now somewhat in vogue. Psychiatry is sup-

¹ Arch. f. Psychiat., 1919, vol. lx.

² Sajous, *Cyclopedia of Pract. Med.*, vol. i, 785, also vol. x, pp. 656-657.

posed to be connected in some occult way with "life problems." The patients are out of harmony with their environment; they have a malady of the soul; and the gross materialism which sees in insanity a mere physical disease, a matter merely of infections and cellular pathology, is not, so we are told, in accord with the advanced thought of the day. The motive in treatment should be to study these dissociations of the personality; to probe to the root of a morbid association of ideas; and by winning the patient's confidence to lead him back to a readjustment of himself to reality. This is doubtless a high aim, and is not to be lightly criticized as leading sometimes to fanciful rhetoric. It is, in fact, a form of the old-fashioned so-called "moral" treatment. It is better adapted to mild melancholias than to patients with confusional and delirious insanity, to whom it is not adapted at all; or than to grave stuporous cases. But it is more appropriate to some of the psychoneuroses, and is discussed along with the treatment for those disorders.

(3) *The Paranoias*.—These patients are the delusional lunatics, whose disorder is usually based on a constitutional or hereditary defect. The delusions are systematized and fixed, and the disease is one of regular evolution. A period of expansive or egotistic delusions may follow one in which the insane ideas had assumed a persecutory form, and the patient may be resentful and dangerous. Many of the criminal insane are recruited from this class. The most striking example perhaps in recent times was Guiteau. Political and religious excitement, and abnormal times, such as the present, are likely to be prolific of such perverts. They can not always be distinguished from the hypomanias, except by the very expert. They are the unbalanced reformers, uplifters, apostles, preachers, politicians, scribblers, inventors, and just plain "cranks," who now infest the world. It would be better if they could all be assigned to the asylums. They cannot be treated by the general practitioner of medicine, or by anyone else, and they may be dismissed here with this passing notice.

In *dementia præcox* we have a mental disease which usually occurs in early life, and is also the expression of a constitutional defect. It presents several varieties, such as the hebephrenic, the catatonic, and the paranoid forms. In the last named the psychosis is similar in some ways to the paranoia just mentioned, but there is the peculiar evolution of deranged adolescence. These cases tend to dementia. They are chronic and mostly incurable, and usually need institutional care. But Upson and others claim to have seen recovery follow the removal of infected teeth.¹

It is, indeed, desirable to remind practitioners that not all cases of juvenile insanity are to be swept indiscriminately into this hopeless class in which they are consigned to an inevitable dementia. The tendency at present is to abuse the term *dementia præcox*. Under hebephrenia are sometimes described cases of confusional and maniacal insanity in which the prognosis is no worse than in the cases of older patients; and catatonia may include cases of melancholia or simple stupor. The fact that the

¹H. A. Cotton, N. Y. Med. Journ., April, 1920.

disease occurs in early life, before the full development of the nervous system, accounts for some of the chief features, such as the juvenile reactions or behavior; and the tendency to more rapid dementia, due to less resistive power. The problems of treatment are not unlike those that present themselves in the more adult forms, which have already been discussed. Most careful attention to nutrition; avoidance of all disturbing things; isolation or institutional treatment; and the greatest pains in using mental influence and promoting rehabilitation; these are the means to be employed. In the paranoid form, as already said, the prognosis is usually not good. Mott¹ finds degenerative changes in the ovaries and testicles; and this might suggest the use of the glandular extracts. The various endocrine glands have also been under suspicion.

(4) *The Psychoneuroses*.—In this class we include hysteria, neurasthenia, and psychasthenia. In most text-books these affections are not classed with mental diseases proper because these patients are not considered to be insane in the technical sense. This prejudice is widespread; nevertheless, it is incontestable that the underlying state is a disorder of mind. To understand and treat the psychoneurotics it is necessary always to consider as of first importance the mental element; and it logically follows that these affections, in a strictly scientific sense, belong to psychiatry, if this science is to be regarded as including a study of all morbid phenomena of mind.

Dr. Pierre Janet, of the College of France, in a recent address in this country took as his subject the relationship of the neuroses and psychoses, and showed that a study of this relationship tends to abolish the generic distinction between these two classes.² "The distinction between the neurotic sufferer and the mental sufferer," he said, "was mostly arbitrary." This is not a mere question of classification, but one of practical usefulness, because the psychoneurotics are mental patients and require treatment which always has this essential state as its objective. Therefore the treatment for these disorders is discussed here.

This therapeutics, however, has become formidable, because it has led to some occult theories about what are called the "mental mechanisms," the "complexes," the "defense reactions," and the "repressed emotions," which are supposed to be the chief factors of disorder, and which are described in a terminology that is not easily apprehended by the inexpert mind. The followers of Freud have for some time held this field as their own. They claim to probe the "subconscious," and to find there the repressed and disordered emotions which are, in their opinion, the mainsprings of the various symptoms. Others, who follow them at a safe distance, discourse on the "dissociation of the personality" and the maladjustment of the personality to the environment. This therapeutics may therefore be called psychological, as distinct from that which seeks for the causes of mental disorders in infections, toxæmias and bodily derangements. But

¹ F. W. Mott, Brit. Med. Journ., Mar. 25, 1922, p. 463.

² P. Janet, *The Neuroses and Psychoses*; an address delivered at the Celebration of the Centenary of the Bloomingdale Hospital, N. Y., 1921.

the two systems are not antagonistic, for in some mental diseases the psychic factors, in others the somatic, are dominant. In discussing here the treatment for the psychoneuroses both of these plans will be kept in view.

The chief motive of the psychoanalysers is to uncover the hidden ideas and emotions which are causing the disorder; to replace them in consciousness; and then to lead the patient to recognize them and to cast them out by a process of "mental catharsis." In order to do all this the patient is catechized, and his memories of his past life are revived by the aid of the association of ideas. The process is tedious; it is not always exact; and it does not always succeed. It can be criticized on the ground, first, that these neuroses are not always dependent on such hidden emotions, but that on the contrary the patient often has a clear recollection of the disturbing events; second, that the tedious methods employed are usually a waste of time, for the patient can be led to unbosom himself without resorting to a ritual; third, that the method leads to a mischievous kind of suggestion, by which the ideas evoked are not always those of the patient but are sometimes those of the doctor; fourth, that the so-called revelation of his hidden self does not always cure the patient, but sometimes makes him worse. Nevertheless, a proper study of the mental state in these patients is essential. This is not a new thing, for such a study in some form or other has long been utilized by those who are qualified to treat these neurotics.

(5) *The Dementias*.—Little need be said here about the various forms of dementia, because from their very nature they do not invite to treatment. The most that can be done for these patients is to take care of them. By the word dementia we understand a terminal stage in which there is a permanent loss of the mental faculties. Not a few of the acute insanities tend to this stage if they are not arrested in their course by treatment or by good fortune. The acute forms of delirium or confusional insanity are usually an exception; but in both mania and melancholia, if the disease is prolonged and recurrent, or becomes chronic, a final stage of dementia is to be feared. In paranoia the tendency is to mental deterioration. In dementia præcox, as the name implies, the natural evolution is towards a final dementia. In the aged we see the familiar form known as senile dementia. Syphilis causes an organic cerebral disease, known as paresis, or *dementia paralytica*, in the final stage of which the patient is as devoid of mentality as it is possible for a man to be and live. We sometimes see the distinction made between *primary* and *secondary* dementia. The older writers understood by the former a mental failure which came on without a precedent psychosis, but this is altogether a problematical form. The latter, or secondary, dementia is that form which follows one or other of the acute insanities, as described above. The *organic* dementias are those in which a morbid anatomy is demonstrable, as in senile dementia and paresis.

Many demented, who are mild and tractable, are cared for in their own homes; many others are sent to the hospitals for the insane. In the more advanced cases the latter course is nearly always inevitable. They do not need or respond to active treatment with drugs.

XXXVII. HYSTERIA.

The treatment for hysteria is largely by suggestion. The disease is so protean that it defies a mere symptomatic treatment. Such treatment should always be subordinate to the main idea of mental influence, for whatever remedies are applied to meet individual symptoms, their usefulness depends upon their making the desired impression on the mind. More will depend on the personality of the physician than on his drugs.

Hysteria is fully described elsewhere (Vol. II, p. 823). It causes paralyzes, contractures, anæsthesias, visceral disorders and convulsions. These may closely simulate organic diseases, but the resemblance is never exact, for there is always something *sui generis* about the grand neurosis. A correct diagnosis is essential, and the grounds for this have been shown in the description of the disease.

These patients often have a bad morale, a bad domestic environment. It is necessary then to secure isolation for them, preferably in a good hospital or sanatorium, under the care of competent and intelligent nurses. The rest treatment may be a part of this isolation. When all this is secured for them, the recovery is usually rapid. Such treatment acts promptly by suggestion. Attention to the general health, especially to nutrition, is necessary, for these patients are sometimes, but not always, in a poor physical state. Only the mildest sedative drugs, if any, should be given. The opiates are positively contraindicated. Such a thing as valerian is given only for its ill smell. Much of the treatment described for neurasthenia is appropriate also for hysteria.

Among the symptoms which are particularly obstinate to treatment are paralysis, contracture, and dysuria. Paralysis may be treated with massage and electricity, but too much should not be made of it, and the patient should be constantly impressed with the idea that she can recover. The same is true of contracture, which is usually painful and demoralizing. Retention of urine should not be relieved with the catheter, if this can possibly be avoided, as it can be if a good nurse is in charge.

The convulsions of major hysteria, as described by the French, are not very common in this country. A too active or meddlesome treatment may be injurious. These patients do themselves no harm in the fit, and it is usually self-limited. Isolation, the banishment of curious spectators, is to be secured. Something which makes a powerful impression on the senses, such as douching, or even a whiff of ether or chloroform, may be effective, if the seizure is long continued. Suggestion may be tried, for the patient, even during the convulsion, is impressionable. Threats of the hot iron or of other painful and alarming measures are, indeed, sometimes effective, but they are hardly to be recommended. Nevertheless, such histrionics are advised by good authorities. The mere mention of applying the hot iron to the spine will sometimes act promptly in the case of some patients who may be exhibiting the bizarre stigmata of hysteria.

It is too much the custom to regard hysteria as a simulated disease, and

to treat such patients as malingerers. This attitude is wrong, and usually disqualifies a physician for the proper treatment of hysterics. The disease is a psychoneurosis, with a well recognized pathogenesis. It may itself be simulated, but the imitation is clumsy and not hard to detect. To treat the genuine hysteric successfully requires insight, tact, and patience, and these things cannot well be taught by book.

During the Great War many cases of hysteria were observed. They were usually of a severe type, such as are caused by shock, trauma, and powerful emotions. They were often called by other names, but their real nature was easily recognized from the descriptions given of them. This experience in war led to a rational treatment, which was mostly by training and re-education; in other words, by suggestion. The literature is large, and of permanent value.

Psychoanalysis, as taught by Freud and his disciples, is now very much in evidence. This deals with repressed emotions, dreams, and defense reactions, as the real factors in hysteria. The subject is involved in a jargon which makes it repellent to the judicious mind and inappropriate in a general text-book of medicine. The mode of treatment is to expose and analyze these hidden processes of the mind, and to cure the patient by an operation of "mental catharsis," or casting out of these morbid complexes. But it is only another way of using suggestion.

XXXVIII. NEURASTHENIA.

This term is defined, and the various conditions or syndromes for which it stands are described elsewhere (Vol. II, p. 828). An exact definition is, indeed, not possible, for the term is used very loosely. It covers a multitude of symptoms as well as mistakes. Yet it stands for something which is not uncommon, and which is likely at some time or other to tax the skill and resources of almost every practitioner.

The first indication in most of these patients is to build them up. They are often badly nourished, always irritable and introspective, unable to attend to their work, discouraged, eating and sleeping poorly, and suffering from disorders of various bodily functions. They should be taken from home and given a chance to build up in a good hospital or sanatorium.

Rest treatment and a rather strict isolation, along with which should go liberal feeding, baths, and massage, are to be tried. This treatment should not be pursued as a ritual, but with due attention to the patient's individual needs and characteristics. The strict rest treatment, once rather popular, is not always required; a modification is better in some cases. Thus the patient may be allowed various liberties, especially such as permit him to pass some hours daily in the open air. The danger in rest treatment is that it degenerate into a hard-and-fast system which takes no account of the patient. As in the case of the other psychoneuroses, such as

hysteria, these patients are usually open to suggestion, and the mere fact that they are receiving systematic treatment has a beneficial effect upon their minds.

Care should be taken of the diet and nutrition. Forced feeding, so-called, may do as much harm as good. It is not wise to overload the alimentary tract with a lot of half-digested food. A common fault is to give too much milk; it impairs the appetite for other food, and obstructs the bowel. Meats are to be given in moderation, or eggs instead of meats, and vegetables and fruits rather freely. It is not likely that elaborate theories about proteins and vitamins will give much help in a difficult situation. More will be gained by weighing the patient once a week, making a blood count, examining the urine, and keeping the bowels active. But feeding is not the whole problem in treating these patients. There are fat neurasthenics, and they are sometimes the most troublesome. To put such patients to bed and overfeed them is unreasonable. They do better with depletion and a light diet.

Bathing is highly beneficial, and should be part of the daily routine. A simple tub-bath is usually the only one practicable, but it does well enough. Other baths, such as the shower, or the Turkish bath, or better than all, the swimming pool, are to be used as occasion offers. Sea-bathing will sometimes act as a specific; but very weak folk, especially women, dread it, and it should not be forced upon them. Much depends on how a patient reacts to a bath. The warm bath is relaxing; a cold plunge, followed by a brisk rubbing down, is the ideal. The neurasthenic, as a rule, should have his bath given to him, not take it himself. This admits of massage right afterwards by the attendant. It is important to choose the time of day for bathing; the morning is best, especially on first rising. A bath at bedtime, especially a warm bath, may not promote sleep. But this is a matter of trial. It is not necessary for patients to go to special hydrotherapeutic plants in order to obtain all the advantages of bathing, except, of course, in the case of Turkish, or other fancy baths. These advantages can be fully gained in a good hospital with the simpler baths, while the patient is under proper care.

Massage is generally much relied on and is usually beneficial, but there are some patients who dislike it, and occasionally it is disappointing.

There has been a reaction against the rest-cure, and some practitioners are prejudiced against it. These go to the other extreme and advise active exercise, even overexercise. But moderation is best. In some cases, no doubt, exercise, especially a light outdoor occupation, gives better results than housing the patient. Gardening is sometimes a good remedy; and outdoor games and systematic exercise, such as walking, are to be approved. Travel, in search of a change of scene, is to be advised with caution. It is expensive and often not very practicable, and the patient takes his troubles with him and returns with them.

Medication means much or little drugging according to the fancy or experience of the practitioner. It can be summed up in a few lines. A

tonic treatment is usually indicated, and sedative drugs are to be avoided. The bromides, chloral, and the coal-tar products can cover up for a time, but cannot remove, unpleasant and inconvenient things. The opiates are forbidden.

Organo-therapy is much exploited at the present time. Various glandular extracts are used in the hope somehow of influencing nutrition.

It is to be borne in mind that a condition closely resembling neurasthenia is sometimes seen as a complication of organic disease. The early stage of Bright's disease sometimes has this appearance. As is well known, neurasthenic symptoms are occasionally among the prodromes of paresis. A careful diagnosis by exclusion is to be made in all cases. Every organ is to be investigated, and tests for any possible infection should be made.

The fundamental fact in neurasthenia is that it is a mental state, a psychoneurosis. That treatment is best which influences for the best the obscure mental complexes. During the Great War many cases were reported which seemed to be of a mixed type of neurasthenia, psychasthenia, and hysteria. The fact that the psychological element is the controlling one has led, just as in the case of hysteria, to more or less elaborate attempts to disclose the underlying mental processes, and to cure the patient by such means as psychoanalysis. Without adopting all the theories and methods of the Freudians, the wise physician will not ignore this essential fact. He will not blindly treat his patient for symptoms which seem to point to mere physical ailments the while he is indifferent to the underlying psychosis.

The emphasis laid on sex by the followers of Freud has been the cause of a general repugnance to his doctrines. The experience gained in the war has shown that the aberrations of the sexual instincts are not alone responsible for all, or even most, of the obscure mental processes that dominate in neurasthenia. Shock, trauma, and the harassments of war caused typical cases, in which it was impossible to trace the operation of repressed sexual emotions. The instincts of self-pride and self-preservation were much more active. All this was not new, but it served to free the subject from unpleasant associations which had gathered about it. There are many instincts and emotions which have nothing to do with sex, but which may be profoundly disturbed in the neurasthenic patient.

Some attempts were made during the war to treat these patients by means of hypnotism. This is a form of induced hysteria, as described elsewhere (Vol. II, p. 827). It is a mental state in which the patient is peculiarly open to suggestion, especially from the person who stands to him in the relation of hypnotizer. It is thus utilized as a method of suggestive therapeutics. From what has been said above, it is evident that the neurasthenic, like the hysteric patient, is influenced by suggestion, and that, directly or indirectly, this is an important part of any plan of treatment, but it can be used without a resort to such a dubious process as hypnotism. This practice was found by competent observers to be not without injurious effects in the psychoneuroses of war.

Much was written about "shell shock." This was merely an aggravated traumatic neurosis, except in cases in which organic injury was done to the brain. But to differentiate the organic from the so-called functional affections was not always easy or even possible. Fatal instances occurred in which organic lesions in the brain were not easily found at autopsy. The usual cases were probably similar to the severe traumatic cases seen in civil life; and Head was doubtless right when he wrote that no new morbid phenomena were evoked by the war.¹ The treatment was the same as for other forms; namely, by time, rest, and re-education. In civil life the *traumatic neuroses* have assumed great importance because they figure largely in claims for damages and compensation. Some of these cases are pure instances of traumatic hysteria, but most of them are properly described as forms of neurasthenia. In the terminology now in vogue, the primitive instincts are disordered in neurasthenia; and in these litigants the chief primitive instincts are those of self-preservation and acquisitiveness, the disorder of which shows itself in a desire to obtain money for their injuries. Treatment is futile so long as their claims are unsettled. Afterwards it is plain sailing, for the patient, no longer having need of a "defense reaction," quickly resumes his normal attitude towards the problems of life, and has no further use for a physician.

XXXIX. PSYCHASTHENIA.

Under this heading is included a series of mental affections in which the patients are dominated by fixed imperative ideas or obsessions. The term, indeed, has been rather loosely used, and does not admit very readily of an exact definition. It literally means mental weakness, or asthenia, and is sometimes confused with neurasthenia. But the definition given above, namely, a psychosis of obsessions, will best answer our present purpose.

The obsessions arrange themselves naturally in several groups or classes. There are the *phobias*, or morbid fears; the *doubts*, or morbid indecisions; and the *impulses*, or tics, by which the patient is driven against his will to perform some useless or even grotesque act. These last named have been described more in detail elsewhere (Vol. II, p. 838). It is necessary to understand the obsessional, or fixed, character of these various stigmata, for it is this character that gives these affections their individuality and serves to group them together. The reactions of the patients to these morbid ideas may be different, but this fixed and imperative character presents the chief problem in therapeutics. Anxiety, restlessness, inability to concentrate upon any useful task, despondency, and, in some cases, very marked disorder of the physical health, are among the results. The patient's conduct and mode of life may be entirely controlled by some morbid fear, as of crowds, open spaces, contamination, etc., or he may engage in endless repetitions and preposterous devices as a result of his morbid doubts, such as dressing and undressing himself, locking and unlocking a door, or putting out and relighting the gas. His morbid impulses, or tics, make him an

¹H. Head, Brit. Med. Jr. Mar. 20, 1920.

object of curiosity or aversion. The intelligence is not impaired in these cases, but the will is entirely subordinated, and the emotional disturbance, as already said, is usually one of anxiety or depression.

The only possible treatment is by some method of suggestion or, if the word is preferred, psychoanalysis. This does not necessarily mean a Freudian ritual, but it must consist in breaking up a highly complex association of ideas, or "mental mechanism," and substituting for it a normal activity of the will. This will tax the mental resources of the most skilful psychiatrist.

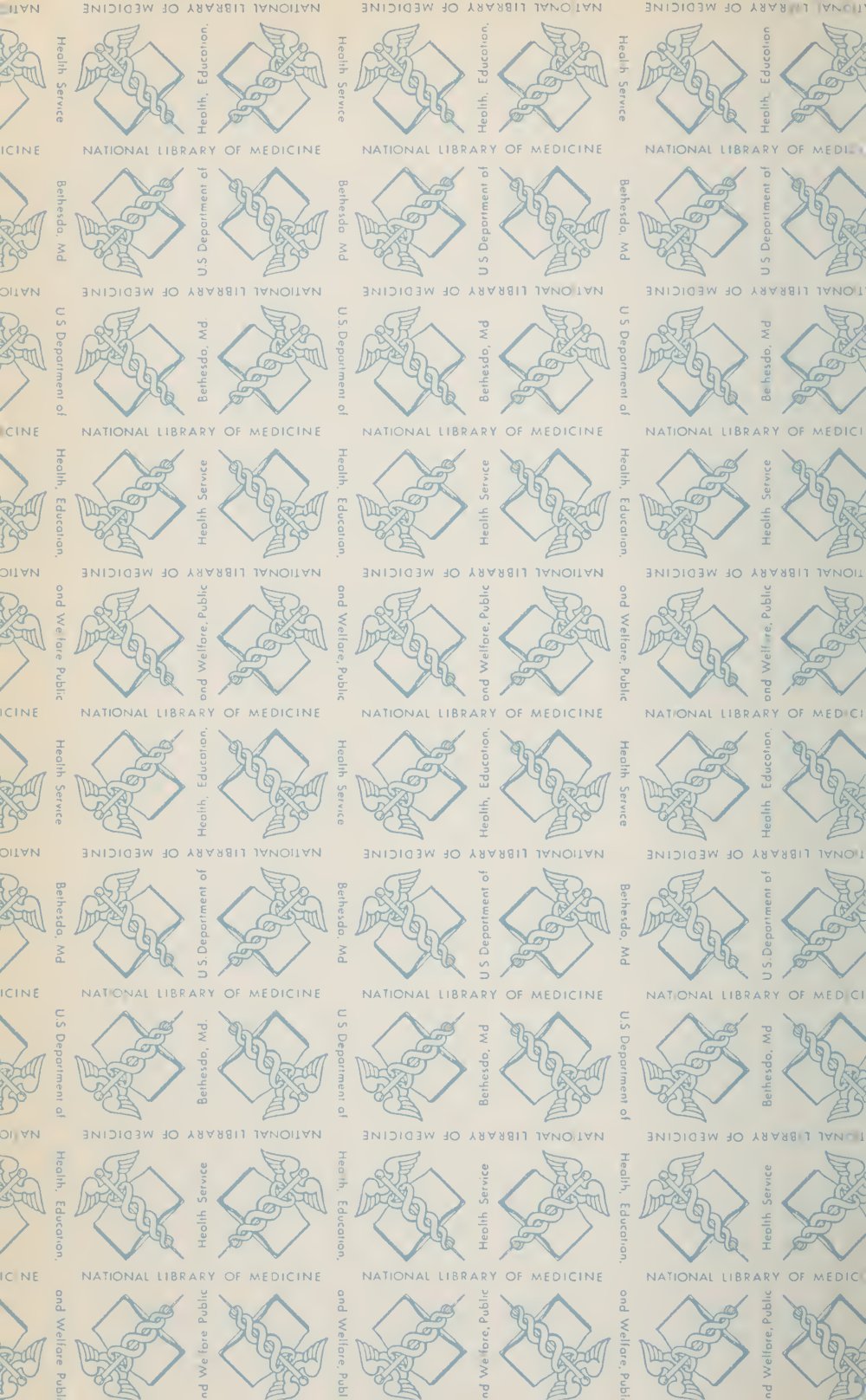
In the tics there is an underlying mental state, which has been pointed out particularly by the French. They are not curable with drugs. They partake of the nature of obsessions, of a motor type, and become fixed and unalterable. In young children certain bizarre habits, which might in time develop into tics, may sometimes be corrected by training and precept, although, as a rule, it is better not to take too much notice of them. The Freudians pretend to see in some of these habits, such as thumb-sucking, an obscure manifestation of the sexual instinct, but such a theory is only the evidence of their own fixed ideas. The confirmed tics of adults are in rare cases associated with obsessions of speech, in which utterance is given to a set form of words, even indecencies, the so-called coprolalia. These rare complications may tend to confirm the psychoanalyzers in the opinion that the tics have an obscure sexual significance or symbolism, and lead them to a trial of their peculiar methods of cure by psychoanalysis, but this subject is too occult for profitable discussion in these pages. The writer knows of no kind of mental therapy, or suggestion, that is able to cure, or even to influence, these patients.

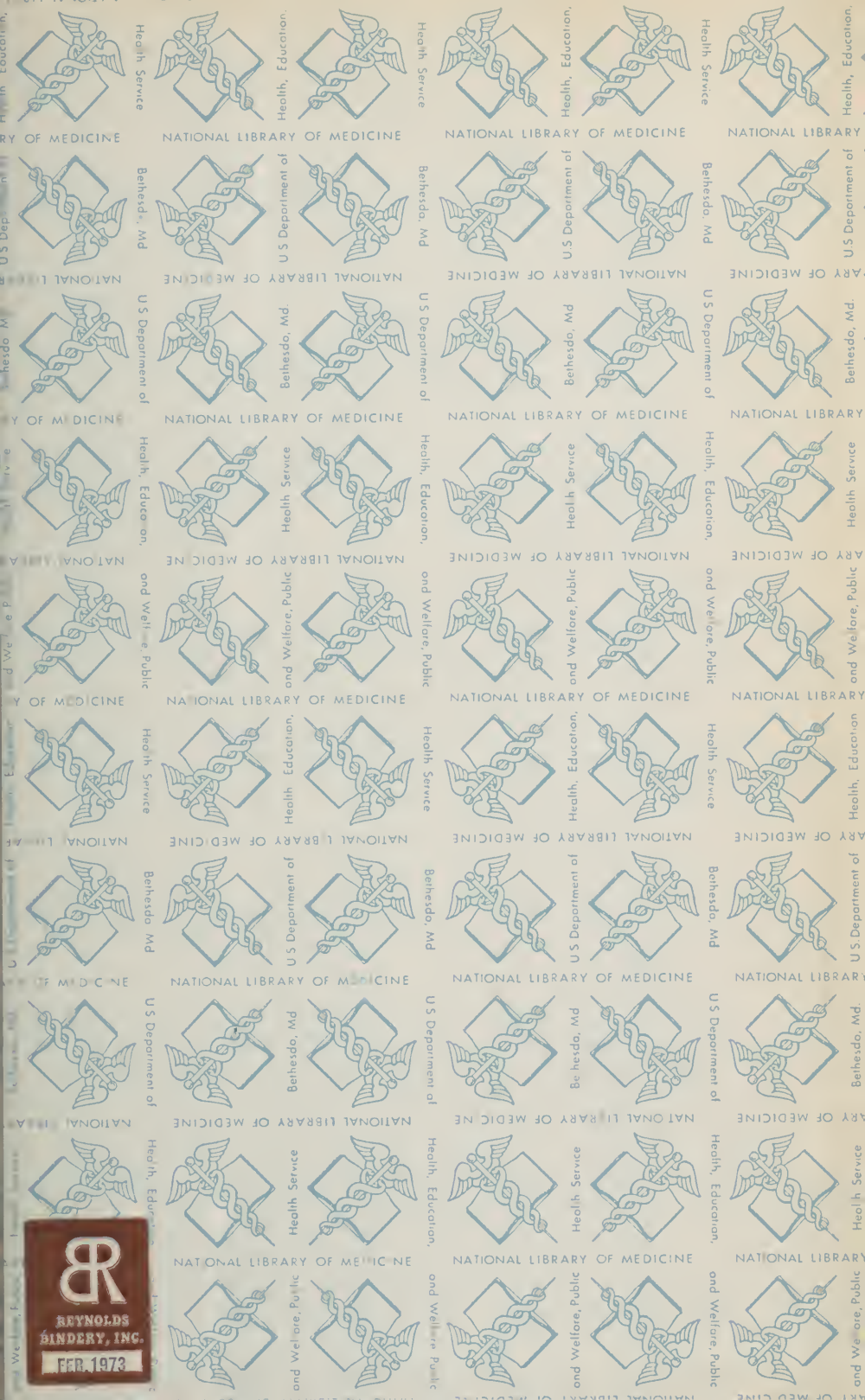
XL. CONCLUSION.

Much might be written about occupations and amusements for the insane.¹ These means of treatment are of importance; and as a rule they are best utilized in the special hospitals. These hospitals, indeed, are usually well equipped for such purposes, and this is one of the advantages which they have over the practitioner who engages in extramural treatment. Indoor and outdoor games, gymnastics, swimming pool, music, lectures, sewing, fancy-work, gardening, modelling, drawing, reading, and even in some cases systematic courses of study, are among the resources of the therapist. The outdoor treatment of the insane has been tried by A. E. MacDonald; the patients are kept in tents or on verandas. This method is especially advocated for tuberculous patients, but it is also beneficial for many others.

The after-treatment of the insane, or the care of convalescents and those who are discharged from active treatment, is never to be ignored. It is well for the practitioner to keep in touch with these patients, to advise them about their resuming their proper place in the world, and by this means to confirm the cure, and to prevent, if possible, any tendency to a relapse or a recurrence of their malady.

¹ Lloyd in Musser and Kelly's *Practical Treatment*, vol. iii, p. 1022.





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